

UNITED STATES OF AMERICA,	:	
	:	12-CR-661
	:	(SLT)
-against-	:	
	:	
	:	United States Courthouse
	:	Brooklyn, New York
	:	
AHMED, et al,	:	
	:	
DEFENDANTS.	:	Monday, April 27, 2015
	:	9:30 a.m.

TRANSCRIPT OF CRIMINAL CAUSE FOR DAUBERT HEARING
BEFORE THE HONORABLE SANDRA L. TOWNES
UNITED STATES DISTRICT COURT JUDGE

For the Government:	LORETTA E. LYNCH, ESQ. United States Attorney BY: SHREVE ARIAIL, ESQ. Assistant United States Attorney DEPARTMENT OF JUSTICE COUNTERTERRORISM SECTION BY: ANNAMARTINE SALICK, ESQ.
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For the Defendant Ali Ahmed:	BY: SUSAN G. KELLMAN, ESQ.
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For the Defendant Madhi Hashi:	BY: MARK S. DEMARCO, ESQ.
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For the Defendant Mohamed Yusuf:	BY: DAVID STERN, ESQ.
	SWEDISH LANGUAGE INTERPRETING BY: GUNILLA MEDINA AND MAGNA CAZGANY

Courtroom Deputy: **Veronica Frullo**

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5 Proceedings recorded by computerized stenography. Transcript
6 produced by Computer-aided Transcription.

7 *****

8 THE COURTROOM DEPUTY: Criminal cause for *Daubert*
9 hearing, docket number 12-CR-661, the United States versus Ali
10 Ahmed, Madhi Hashi and Mohamed Yusuf.

11 Counsel, please state your names for the
12 record.

13 MR. ARIAIL: Good morning, your Honor. Shreve
14 Ariail and Annamartine Salick for the United States.

15 THE COURT: Good morning.

16 MR. STERN: Dave Stern and Jane Simkin Smith for
17 Mr. Yusuf. And I'm here with James Wayman, who is an expert.

18 MS. KELLMAN: Susan Kellman for Ali Ahmed. My
19 client is present in court.

20 MR. DeMARCO: Mark DeMarco for Mr. Hashi. Good
21 morning.

22 THE COURT: Good morning. I received a letter from
23 the government dated April 26th requesting to briefly reopen
24 direct to ask questions of Mr. Lindh based on questions that I
25 asked. I'm going to allow it.

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1 MR. ARIAIL: Thank you, your Honor.

2 THE COURT: All right. Mr. Lindh.

3 MR. STERN: Before we do that, we received
4 material last night at 10:30 that I take it is relevant to
5 Mr. Lindh. I haven't read it. I don't really understand it
6 even when I look at it briefly. And I'm not prepared to
7 cross-examine. I don't know how many pages it is. The
8 government can tell us --

9 THE COURT: Come on, up Mr. Lindh.

10 (Witness resumes the witness stand.)

11 MR. STERN: -- exactly what it is. But, you know,
12 this is technical material, which I am not familiar with
13 because I'm a lawyer. And I don't know how I'm expected to
14 cross-examine when I get things at 10:30 last night to
15 cross-examine today.

16 MR. ARIAIL: Your Honor, if we may just briefly
17 address it. Obviously, the materials that we turned over
18 this morning were generated yesterday and over the weekend.
19 They are a brief summary by Mr. Lindh of error rates in
20 response to your Honor's inquiry. There is an assessment
21 regarding the nature of his conclusions as they relate to
22 error rates.

23 THE COURT: Let me ask you something. Well, let
24 me ask Mr. Stern.

25 Is the information that you're talking about the

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1 letter that was filed, the seven-page letter, or is
2 there --

3 MR. STERN: No, I don't think so. There is
4 something hear dated 6-25-15 that has no author but is
5 entitled -- or has no listed author -- but is entitled
6 "Simplified Explanation Regarding Forensic Speech
7 Comparison, case 12-CR-661." Then there is a bunch -- and I
8 haven't looked at it carefully, but there's technical
9 material from I think Agnitio. There is something from
10 something called the International Biometric Group.

11 I don't know what any of this stuff is. I'm just
12 telling you what it's titled.

13 MR. ARIAIL: All these materials, your Honor, with
14 the exception of the report, which is dated 4-25-15
15 actually, were produced in discovery to the defense and have
16 been identified as 3500 material in connection with this
17 proceeding. So VIM-7, VIM-12, those were documents that
18 were previously produced to the defendants and they have had
19 these materials.

20 THE COURT: VIM? I don't know to what you're
21 referring when you say "VIM." I'm assuming I have this.

22 MR. ARIAIL: You do, your Honor. The attachments
23 to the letter that the government produced were previously
24 provided in discovery to the defense as part of its
25 disclosures in connection with this hearing last Friday. So

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1 the defense has had these documents. We just flagged them
2 for the Court so as to focus them as they relate to the
3 error rates and other points. There's one abstract that's
4 one page long that I believe is marked Government's Exhibits
5 E that is an abstract that was also provided in response to
6 your Honor's inquiry on Friday regarding the effect of voice
7 analysis over time.

8 But there's very minimal new material here so
9 there's literally one abstract that's one page long and a
10 six-page summary that Mr. Lindh created yesterday.

11 MR. STERN: When they say it's minimal, it might
12 be minimal if I were a voice identification expert, but I'm
13 not. So I have to read this, talk to our expert, try to
14 understand it, think of if it needs to add something or not
15 something to our cross. We worked on that cross all day
16 yesterday and then got this at 10:30 at night.

17 THE COURT: So what we can do is go with what you
18 have and then I'll give you an opportunity to review.

19 MR. STERN: Okay. You mean, to recall him if I
20 think I need to?

21 THE COURT: Correct.

22 MR. ARIAIL: Just to clarify, it was an effort by
23 Mr. Lindh to simplify the information that was previously
24 provided to the defense so that it would be more digestible
25 to the parties and obviously to the Court as well.

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1 THE COURT: You know, it should say that then.

2 MR. ARIAIL: Certainly.

3 MR. STERN: Whatever it is, it's a new statement
4 by Mr. Lindh. I assume it's a new statement.

5 Is it by Mr. Lindh because it not titled.

6 MR. ARIAIL: It's entitled "Simplified explanation
7 Regarding Forensic Speaker Comparison." I think it's pretty
8 evident that that's what it is.

9 MR. STERN: Having read it, it doesn't strike me
10 as that simple so I know it's entitled "Simplified" --

11 THE COURT: Sit down. Sit down. I'm not going to
12 put up with this. I'm not going to put up with it. You
13 know, you two sniping at each other and acting like children
14 is going to stop and it's going to stop right now.

15 MR. ARIAIL: Apologize, your Honor.

16 THE COURT: Mr. Lindh, you are still under oath.

17 THE WITNESS: Yes.

18 DIRECT EXAMINATION (Continued)

19 BY MS. SALICK:

20 Q Good morning, Mr. Lindh.

21 A Good morning.

22 Q At the conclusion of the hearing on Friday, do you
23 remember when the Court asked you some specific questions
24 about calculated error rates?

25 A Yes.

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1 Q I'd like to go through some of those with you now for
2 some clarification.

3 First, can you define what an error rate is.

4 A So an error rate, you're derived at an error rate by
5 having an evaluation. An evaluation is made or consists of
6 many different comparisons of a big, big database of voice
7 recordings. They could be of different qualities recorded
8 with different microphone types, phone recording,
9 interviews, et cetera and so on. In the evaluation, you are
10 then forced to make a decision for all of those comparisons
11 so that means this match, no match conclusion. So in that
12 sense, it's not reasoning within probabilities or both
13 probabilities, because you have to make a threshold
14 somewhere on and make a decision on whether it is the same
15 or not.

16 Q And we'll get to your personal dislike of error rates
17 as an expression of reliability in just a second.

18 A May I add one thing?

19 Q Absolutely.

20 A It's important also that you can't in an evaluation
21 punt any of the comparisons, for example. You are provided
22 with a set that you have to compare. So it means you can't
23 say, oh, these recordings are of extremely bad quality, I
24 will not compare them, for example, okay.

25 Q So Mr. Lindh, in other words, in the case that -- in

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1 the analysis that you did, did you ever punt on any of the
2 samples you were provided?

3 A In this case?

4 Q Yes.

5 A Yes.

6 Q Very briefly to remind the Court, why did you do that?
7 What about those samples made you punt?

8 A Because they were of very low quality the audio
9 recordings.

10 Q So one of the problems you have with calculating error
11 rates is that it forces you to make a decision, to make a
12 match or no match decision, when in the real world you
13 wouldn't -- you couldn't punt?

14 A Yes.

15 Q Okay. Can you explain the difference between an error
16 rate and an equal error rate.

17 A So the equal error rate is at the point in an
18 evaluation where false acceptances and false rejections are
19 at the same level.

20 Q So if you had an equal error rate of 5 percent, how
21 many false positives would you have -- excuse me, false
22 acceptances would you have and how many false rejections
23 would you have?

24 A 5 percent.

25 Q Okay. So let's say you were testing 100 samples. How

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1 many false rejections and how many false acceptances would
2 you have?

3 A Five each.

4 Q And if it was just an error rate and not an equal error
5 rate, out of 100, how many false rejections would you have?

6 A I've seen many different kinds of variations, but some
7 of them would just report, for example, like number of
8 identifications, for example, so 99 percent were correct,
9 for example.

10 Q So there are many different ways to express an error
11 rate?

12 A Yes.

13 Q And an equal error rate is one measure?

14 A Yes.

15 Q You discuss a little bit about how an error rate is
16 calculated in the threshold and why that's necessary. What
17 amount of data do you need to calculate an error rate?

18 A So, yeah, that's a good question. Evaluation is
19 basically its own science when it comes to biometrics. So
20 thousands, presumably. At least hundreds.

21 Q You would need many, many tests --

22 A Many different speech recordings of both same and
23 different that you compare all of them.

24 Q And is the -- how is the threshold, which, again, you
25 mentioned earlier which is the decision at which point you

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1 say, yes, this is a match or, no, this is not a match, how
2 is the threshold determined?

3 A If you have a commercial system, for example, that you
4 have voice recognition for letting you in through a door,
5 that would then be called verification, you would have to
6 within the evaluation try to find the threshold where the
7 equal error rate is at its lowest point, presume it's the
8 best. And then of course it depends on in the commercial
9 sense how important it is to make the system easy than maybe
10 the threshold is put a little bit more so there are more
11 false acceptances, for example, if the security isn't that
12 high. And then if the security is extremely high, they
13 remove the threshold to have less false acceptances. And
14 then you decrease on the other side. Understand?

15 Q So in evaluating error rates, the threshold, the level
16 at which the no match and match is decided, is a subjective
17 determination?

18 A Not equal error rate, but you could decide the
19 threshold as you want, yes.

20 Q Someone, the evaluator, whoever is evaluating the
21 system, decides where to put the threshold?

22 A Yeah.

23 Q And I think you mentioned that, you know, your own
24 dislike of error rates. Can you explain to the Court why
25 that is, why it's not a good measure of reliability.

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1 A It doesn't take into account the two probabilities. So
2 if you would use likelihood ratios in the calculation or an
3 evaluation, you usually use some kind of cost measure. And
4 that means the dispersion of all those likelihood ratios in
5 two directions basically.

6 So instead of an equal error rate, you would have
7 some cost depending on if it's the same voice, comparison
8 gives a very high likelihood ratio, for example, in one
9 direction. Or if it's a different voice comparison, the
10 likelihood ratio in the other direction is very big or very
11 low. That would generate a cost. So the lower the cost,
12 that would then say something about the evaluation.

13 Q So an evaluation that calculates error rate, unlike in
14 your own analyses, you're required to make a match, no match
15 determination?

16 A Yes.

17 Q And part of your disagreement with the calculation
18 error rates is that you believe it is better to express
19 these conclusions in terms of probability?

20 A Yes. May I add something? So it's extremely important
21 when you're calculating or judging the two different
22 probabilities that especially with the technology like this
23 that it's -- it is fragile, so you have to -- it's very
24 important that it's collaborative evidence. It's weighing
25 the two different probabilities.

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1 And that's what I was trying to explain, that it's
2 up to the trier of fact to actually decide the probability
3 of the two voices coming from the same voice. And that's
4 very important, I mean. And this is just weighing you in
5 some direction. There might be other things that come up,
6 other evidence, other statements, testimony, I don't know
7 what can be in trial that would weigh this, and that will
8 also to some extent also add to the reliability of the
9 examination.

10 Q So other evidence that may be presented in trial
11 would -- I'll withdraw that. I'll move on.

12 Turning now to phonetic and linguistic analysis,
13 which is something we discussed at length on Friday. Are
14 you aware of any evaluations of forensic, phonetic and
15 linguistic analysis that have calculated an error rate?

16 A Only when it comes to the acoustic measurements of
17 phonetic properties. Normally acoustics is a part of
18 phonetics, but when it comes to linguistic and phonetic
19 judgments, you would have to have many different experts, of
20 course, going through thousands of comparisons of same voice
21 samples and different voice samples to be able to evaluate
22 that. That has not happened.

23 Normally and also in the tradition of linguistic and
24 then phonetic research or science, you do -- you look at
25 discriminative functions and a few parameters. You will

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1 look how well does these things discriminate between
2 speakers.

3 Q So due to the nature of how phonetic and linguistic
4 analysis are conducted, it would be very difficult to
5 calculate an error rate?

6 A Yes.

7 Q Turning now to acoustic analysis. Are you familiar
8 with any evaluations of acoustic analyses that may have
9 resulted in a calculated error rate?

10 A Yes. There are several, especially concerning formant
11 analyses and fundamental frequency analyses.

12 Q And in preparation for today's hearing and reviewing
13 the references that you cited in your own report, did you
14 find an evaluation that was applicable to this case?

15 A Well, yeah. There are several done by the German BKA
16 who also use vocalized. And both on its own using formant
17 analysis and in conjunction with automatic --

18 MS. KELLMAN: I'm sorry, your Honor. The witness
19 is dropping his voice. It's difficult to hear.

20 THE COURT: Yes.

21 THE WITNESS: Is this better?

22 MS. KELLMAN: Yes.

23 THE WITNESS: I'll be closer to the microphone.

24 So they have done several evaluations on using
25 only formant analyses and also specific formant analyses on

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1 specific vowels in specific instances, okay. And also in
2 most of them they also look at fusion together with an
3 automatic system, see if it improves or if it doesn't
4 improve, the automatic system on its own.

5 BY MS. SALICK:

6 Q So in one of those evaluations by the German BKA; is
7 that correct?

8 A The BKA, Bundeskriminalamt.

9 Q And what is that?

10 A That's the government agency in Germany performing all
11 forensic analyses basically.

12 Q And in one of those evaluations, was an error rate
13 calculated for acoustic analysis?

14 A For formant analysis, yes. The one by Michael Jessen
15 using vocalized -- he used both long-term formant analysis
16 and together with formants use measured at specific vowels.

17 THE COURT: And what is the name of the scientist
18 you just said?

19 THE WITNESS: Michael Jessen in more English
20 pronunciation, I think. So he works at the BKA.

21 BY MS. SALICK:

22 Q And that was reference number 9 in your report which
23 has previously been provided. And what was the numeric
24 value of the error in that evaluation?

25 A I do not recall exactly, but I think it was around 8

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1 percent equal error rate.

2 Q Are you familiar with evaluations of Batvox, the
3 technology that you used in this case, of its core
4 technology?

5 A Yes.

6 Q Are you familiar with any evaluations of Batvox's core
7 technology that has determined an error rate?

8 A Yes.

9 Q Approximately, how many evaluations have looked at
10 Batvox's core technology?

11 A I think most proper it would be to ask Agnitio that as
12 they have done many different evaluations. And I'm
13 not -- both internally and also that they have published.
14 So I don't know how many there are that are published. So
15 some are published by themselves performing evaluations like
16 the NIST. And then other laboratories have done an
17 evaluation using the software on their own databases, for
18 example.

19 Q Is it fair to say there are several evaluations of
20 Batvox's core technology?

21 A Yeah. Many, many different and between different
22 conditions. So there's not just one equal error rate if one
23 wants to do equal error rates. There are many more
24 different lengths of recordings and different channel
25 conditions. So interview against phone, mobile phone

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1 against landline, mobile phone against mobile phone with one
2 sample, with several samples. And then you can tweak
3 different algorithms and different statistical modeling
4 within the technology to see how to optimize the results in
5 an evaluation.

6 Q And you just mentioned that during these evaluations,
7 they test different conditions, different recording devices
8 and comparing those. Are you aware of an evaluation of
9 Batvox's core technology that compared phone recordings to
10 other phone recordings?

11 A Yes.

12 Q Okay. And do you remember the approximate equal error
13 rate that was calculated for the comparison of Batvox's core
14 technology comparing phone recordings to phone recordings in
15 that evaluation?

16 A So there are several spans depending on length of the
17 recording as well and how many recordings are used at the
18 training level and so on. So I think the span is somewhere
19 between like less than 1 percent all the way up to 5 percent
20 probably.

21 Q And the reason for that span is that even in comparing
22 telephone to telephone, there are other conditions that the
23 examiner can set such as the length of time of the
24 recordings that are compared or the amount of noise in the
25 recording compared?

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1 A Yeah. So there are several standards that the
2 software, it forces you to stick to, length requirement, and
3 it also does check the signal-to-noise ratio. Also checks
4 the similarity to this reference population. So there are
5 several things there. And then it's also up to the
6 examiner, of course, to punt different low-quality
7 recordings.

8 Q When you say "punt," you mean to exclude a sample?

9 A Yes.

10 Q This evaluation that we've been talking about, do you
11 remember who conducted it?

12 A There are many different. NIST as done several
13 evaluations. There are others that I need to have employed.
14 I don't know if they are government or commercial
15 organizations to perform evaluations on their core
16 technology. The Italian evaluation I mentioned. Partly
17 more forensically relevant. And then there are evaluations
18 done within the European laboratories.

19 I'm currently helping out the Dutch Forensic
20 Institute to evaluate Batvox on those mismatched conditions
21 and different lengths of mobile phone recordings. So there
22 are many.

23 Q And just to make sure we're all on the same path in
24 terms of acronyms it, what does NIST stand for again?

25 A National Institute of Standards and Technology, I

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1 believe.

2 Q And are they the major group in the United States
3 performing evaluations on forensic speaker technology?

4 A They are biometric technologies, I think.

5 Q Is one of the areas of NIST that it evaluates speaker
6 recognition or voice comparison technologies?

7 A Yes.

8 Q And just to remind the Court, who is Agnitio -- or what
9 Agnitio?

10 A The company that sells Batvox.

11 Q And what we just discussed comparing telephones to
12 telephone recordings, that's called a matched evaluation; is
13 that correct?

14 A Matched conditions.

15 Q And that's because the condition is telephone and the
16 other side that they are evaluating is also telephones?

17 A Yes.

18 Q Okay. Is there also something called mismatched
19 conditions?

20 A Yes.

21 Q And what is that?

22 A So that would be a recording on one side that is, for
23 example, then microphone on the other side, telephone.

24 Q And are you aware of any evaluations of Batvox's core
25 technology comparing its ability to compare a recording

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1 under a microphone condition and a recording under a
2 telephone condition?

3 A Yes.

4 Q And in such an evaluation, was an error rate
5 calculated?

6 A The only one I seen publicly available is done by what
7 I think is a commercial institute that I can't remember the
8 name of, but I know it was included here somewhere, which
9 had a very, very low error rate.

10 Q And what was the error rate, approximately, if you can
11 remember?

12 A Less than 1 percent misidentification. Those were
13 under very good conditions. Must be added to that. Very
14 good conditions.

15 Q What does that mean?

16 A Recordings. There are no overlapping, no other people
17 in the room. No noise added to the recordings. That's all.
18 That's why I think it's a very good comparison, even though
19 it does test the mismatched conditions. So microphone and
20 telephone.

21 Q And was it the International Biometric group that
22 tested Batvox's core technology comparing a microphone to a
23 phone sample?

24 A That sounds familiar. I should add to that that of
25 course there are many internal evaluations before buying the

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1 software by government agencies. Those are not -- normally
2 not published.

3 Q Did you personally evaluate Batvox software before you
4 purchased it?

5 A Yes.

6 Q Was this a formal evaluation or just from your use
7 of --

8 A Because of the sensitivity of the data, for example,
9 when it comes to the Swedish interception system and other
10 things, it's only for us and the NFC.

11 Q So understanding that your evaluation wasn't public
12 because of the sensitivities you mentioned.

13 A Yes. So when you do research in Sweden at least, if
14 you publish something when you've done an evaluation, you
15 have to make the data available for any other researcher.

16 Q And due to the sensitivity of the data, you couldn't
17 make that available?

18 A Exactly.

19 Q What was your opinion as to the Batvox technology
20 compared about other automated voice comparison systems
21 available?

22 A So I had been using for my Ph.D. work for many years
23 this ALIZE open-source software from the university of Avion
24 in France. So in the end -- I could make this very long;
25 I'm trying to keep it short.

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1 Already back ten years ago, there was a meeting at
2 the NFC on where Agnitio was invited to present their
3 different software both for the NFC and the Swedish Security
4 Service. I was an invited expert to listen to their
5 presentation and talk about it. Back then I was working
6 very hard on how to use the ALIZE open-source software in
7 forensic cases.

8 So at that meeting afterwards, they asked me to
9 evaluate what was the information given. And I then
10 rejected -- I made the recommendation that they should not
11 buy Batvox at that point because the internal evaluations I
12 had done then basically gave this more or less same result
13 as Batvox did.

14 In 2010 approximately, though, it was a different
15 story. So in communication with the NFC it was decided,
16 because the software is extremely expensive as well, that we
17 should evaluate Batvox. And for one year we used, for
18 casework, we were using both software actually in
19 conjunction for casework, but also at the same time
20 performing internal evaluations of the software. And as I
21 was actually using the technology and I was the one
22 programming everything around it, it was like competing with
23 the 2013 scientists at Agnitio. And the performances were
24 extremely good compared to mine, to my version of the ALIZE
25 software. So especially for mismatched conditions like in

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1 the Swedish case, it's normally interview recordings with
2 certain devices compared to telephone recordings.

3 Q And after reaching a decision that in 2010 Batvox was
4 far and above the better system, did you then purchase it?

5 A Yes.

6 Q And is -- what model of Batvox again did you use in
7 this example?

8 A Ours was version 3 back then.

9 Q Today for the report in this case, which version did
10 you use?

11 A That's version 4.1.

12 Q So it's an even newer version that you're using today?

13 A Yes.

14 Q Understanding the error rates that have been calculated
15 by some evaluations of Batvox between a range of .4 percent
16 to 5 percent, giving very general error rates, are there
17 anything you do -- is there anything you do in using Batvox
18 that may further reduce this error rate?

19 A One can only hypothesize as long as you don't do even
20 more evaluations where you have the impressionistic
21 linguistic and phonetic analysis and also the punting that I
22 was talking about done for all the different comparisons in
23 an evaluation. So one can only hypothesize on the effect of
24 doing an evaluation, removing everything that is judged with
25 too low audio quality and also where you find a post results

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1 for the phonetic and linguistic analyses to reduce error
2 rate in that case.

3 Q So one method of further reducing an error rate would
4 be to ensure that the samples you put into Batvox meet both
5 the quality and quantity requirements?

6 A Yes, of course.

7 Q And in addition to that mechanism for reducing the
8 error rate, how does the combination of the three methods
9 that you used in this case reduce the isolated error rate
10 for Batvox?

11 A You use error rates. You cannot know if you haven't
12 evaluated completely. But you can hypothesize that if you
13 remove low audio recordings the error rate will decrease,
14 right. And also if you do phonetic and linguistic analyses
15 looking at similarities in the speech behavior of a person,
16 you can then further hypothesize that probably if they are
17 opposed to what you get in the test, the test is less
18 reliable. For example, if you like the exact number of the
19 likelihood ratio, that would become lower in that case.

20 Q So if you received a score from Batvox on a sample that
21 was different from your analysis under linguistic and
22 phonetic analysis, how would that inform your overall
23 conclusion?

24 A So it would boost it or lower it.

25 Q So the result that Batvox gives you, you weigh based on

1 the other analyses you've run in the overall examination?

2 A Yes.

3 Q Also on Friday you were asked to clarify understandably
4 some of the very, very complicated technology in this case.
5 And one question from the Court was what a statistical model
6 is.

7 Can you explain what a statistical model is.

8 A So it's a very complicated process, but the only graph,
9 figure I remember and that I can relate to is kind of
10 three-dimensional map with many different hills and valleys
11 and mountains of different shapes. Those are adapted to a
12 different statistical model from many, many different
13 speakers to sort of fit within that universal space.

14 Q So before we get into how Batvox uses statistical
15 models, just defining what a statistical model is, you
16 mentioned hills and valleys.

17 A Those hills, valleys, mountains of different shapes in
18 this kind of three-dimensional map would, to a large extent,
19 then of course reflect the different vocal tract features
20 from the voice that the statistical model is modeled from.
21 So to some extent it will also probably contain some of what
22 you would call noise, so unimportant stuff in there in the
23 first modeling. So you want to reduce that in many
24 different ways.

25 So this new I-vector technology, for example,

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1 tries to extract from that model what is not important for
2 those features belonging to that specific voice. So it's
3 actually like subtracting that part in the modeling process.
4 I hope that makes a little sense.

5 Q So thinking about what a statistical model of a voice
6 sample would look like, you mentioned hills and valleys.
7 Are these things that we saw on Friday a distribution of a
8 line?

9 A That's simplified, yes. Looking three dimensional.

10 Q So each line would represent a measurement of a
11 different feature of that voice?

12 A Yes. One single. So if the vocal tract is divided
13 into several sections from your vocal cords all the way to
14 your lips, they will somehow reflect different pieces of
15 your vocal tract.

16 Q So one curve would represent one feature?

17 A Yes.

18 Q And the statistical model is the three-dimensional
19 combination of all of these curves in a three-dimensional
20 space?

21 A Yes.

22 Q In its most simplistic?

23 A Yes.

24 Q And what does the combination of those distribution
25 curves represent in the statistical model? What do they

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1 portray?

2 A So different parts of your vocal tract, the features
3 reflecting vocal tracts. So all in the feature extraction
4 process, that's like one reflection of all those sections of
5 the vocal tract in points of time. So like a window in
6 time. The statistical modeling is used in all those
7 extracted time frames merging them together in a statistical
8 model.

9 Q And in just a second we're going to talk about exactly
10 what a Gaussian mixture model is, but is a Gaussian mixture
11 model a statistic at model?

12 A Yes.

13 THE COURT: And is that -- what is the first word
14 you're saying?

15 THE WITNESS: Gaussian. Gaussian is basically
16 only a normal distribution curve. So a bell curve.

17 THE COURT: Yes. Gaussian.

18 THE WITNESS: A mixture model is then a three
19 dimensional kind of bell curve.

20 BY MS. SALICK:

21 Q So the Gaussian mixture model is a three-dimensional
22 statistical model of the voice?

23 A Not necessarily three dimensional, but yes.

24 Q All right. Moving on to perhaps a more simplified and
25 easier to understand explanation of the steps that the

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1 Batvox software takes.

2 After the samples are entered into Batvox, can you
3 explain what feature extraction is and what it does.

4 A So that's what I was just trying to say there. So with
5 like 20 millisecond internals, the window at every time
6 point is trying to reflect these vocal tract features by
7 extracting these mel-frequency cepstral coefficients.

8 Q So let's start with the known samples. So the known
9 samples, when you enter them into Batvox, the feature
10 extraction starts by recognizing features at a time
11 interval; is that correct?

12 A Yeah. It extracts them by overlapping time frames.

13 Q So it breaks down the sample into 20 millisecond
14 portions?

15 A Yes, yeah.

16 Q And at every 20 millisecond interval it extracts
17 certain features?

18 A Yes. Overlapping 20 millisecond.

19 Q And you mentioned the mel-frequency cepstral
20 coefficients. That is the mechanism to extract those
21 features?

22 A Yes. Acoustic measure that's trying to reflect the
23 vocal tract at a certain instant in time.

24 Q And just like DNA extracts certain features and
25 fingerprint extracts certain features, an automated voice

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1 comparison system is extracting these mel-frequency cepstral
2 coefficients?

3 A Yes.

4 Q And mel-frequency cepstral coefficients is abbreviated
5 as MFCC?

6 A Yes.

7 Q We'll use that moving forward to make it a little
8 easier, okay.

9 So once the features have been extracted using
10 this MFCC, are those features then modeled in a statistical
11 model like the one we just discussed?

12 A Exactly, yes.

13 Q Okay. And what is the system or the name of the
14 modeling system?

15 A So I-vector or GMM.

16 Q And GMM --

17 A Gaussian mixture model.

18 Q And this again is that distribution of each feature in
19 a model?

20 A The hills, sun, valleys.

21 Q Okay. At this point we have put the samples into the
22 software system, extracted certain features just like you
23 would in DNA or fingerprints and then modeled the
24 measurements, the values of those features in --

25 A Since they are taken at instances in time, you know,

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1 you want to have something that merged the -- removes the
2 time estimate for it or the time -- it's not important the
3 time thing.

4 So it's only the more you have, to some extent,
5 the better that you can model it because you're merging the
6 time frames somehow. Okay.

7 Q Because there is so much data because this system takes
8 measurements at every 20 millisecond interval?

9 A Yeah.

10 Q So once this statistical model is created, and in this
11 case we're talking about the known samples, a statistical
12 model of all the known samples, is it compared with
13 something called the universal background model?

14 A Yes.

15 Q Okay. What is a universal background model?

16 A Same kind of model but made from thousands of
17 recordings. And in the Batvox case, thousands of recordings
18 of interview, telephone, microphone, many different kinds of
19 recordings. The only thing -- there are actually two
20 because there's one female and one male. So it actually
21 automatically decides gender confidence. So it will use the
22 male or the female universal background model.

23 Q So backing up, you said it's the same model, meaning
24 universal background model is also a statistical model?

25 A Yes.

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1 Q And just like we just went through this how you create
2 a statistical model of all of the data for the known
3 samples, the universal background model is the combination
4 of all of the features extracted from, as you said,
5 thousands and thousands of recordings?

6 A Yeah, yes.

7 Q And Batvox has two universal background models, one
8 female and male?

9 A Yes.

10 Q Why do you compare the statistical model of the known
11 speaker sample against the statistical model of the
12 universal background model?

13 A There is an adaption process. So in that enormous big
14 space, you try to fit the model of this known sample into
15 the universal background model. So you move it to see
16 where, how it's placed within that.

17 Q And when you say you fit it --

18 A Adaption is a better word.

19 Q That shows you how unique and how dissimilar the
20 features that were extracted from the known sample are
21 compared with the universal background model?

22 A Yes.

23 Q And is the resulting comparison called a trained GMM?

24 A Yes.

25 Q In other words, the comparison of the statistical model

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1 of the known samples with the universal background model
2 trains the resulting model of the known samples?

3 A Yes.

4 Q So you now have more information about the known
5 samples?

6 A Yes.

7 Q So we've been talking now about just the known samples,
8 the samples that are known to come from one person. Does
9 the unknown test file also undergo a similar process?

10 A No. Then you use actually the MFCCs more directly.

11 Q Can you --

12 MS. KELLMAN: I'm sorry, your Honor. I missed
13 that answer.

14 THE WITNESS: No. You use the MCFFs extracted
15 more directly.

16 BY MS. SALICK:

17 Q The MFCCs we talked about earlier is the method of
18 extracting specific features?

19 A Yes.

20 Q So the unknown sample, Batvox also extracts the
21 relevant features from the unknown sample?

22 A Yes.

23 Q Are there additional procedures within Batvox software
24 that improve the models for the statistical -- for the
25 unknown sample and for the unknown -- excuse me, for the

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1 known and unknown samples?

2 A Yes.

3 Q What are they and can you explain them?

4 A So they are trying to exclude channel information. So
5 the information that actually belongs to background noise or
6 microphone use or other information not belonging to the
7 actual voice. So it's trying to remove. We call all of
8 that noise. There are several processes that try to remove
9 that noise.

10 Q So there are systems within Batvox that further remove
11 features and elements of the sample that aren't attributed
12 to voice?

13 A Yes.

14 Q And is one of those methods cepstral means extraction?

15 A Yes.

16 Q And another one called I-vector?

17 A Well, the I-vector is used in modeling part, but yes,
18 you could say that.

19 Q Do both of those mechanisms remove features that are
20 not attributed to the voice?

21 A Yes.

22 Q Okay. What does mel-frequency filters do?

23 A It uniquely fits the frequency scale to look more the
24 way we perceive sound.

25 Q So it further refines the samples?

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1 A It will boost different frequencies differently. And
2 the model is more based on our ear.

3 Q So the mel-frequency filter adapts the model to fit the
4 human ear better?

5 A Yeah. So the mel filters are actually based on a test
6 where you had like one sign telling one ear and the subjects
7 were asked to double frequency, for example. And they had
8 to turn the knob until they thought the frequency was double
9 that or half the frequency of the other one. So just
10 impressionistically, you could think that the results would
11 end up all over the place, but people actually perceive
12 tones in a very similar manner. So you can adjust the scale
13 according to that.

14 Q All right. So we discussed feature extraction and how
15 a statistical model is created for the known sample and how
16 that is further -- that sample is further refined by the
17 universal background model. And we've also talked about how
18 the unknown sample undergoes a similar process of feature
19 extraction. At some point are both samples -- do they go
20 through a process of normalization?

21 A Yeah. That's what we just were talking about.

22 Q So what is normalization?

23 A So this is the normalization that has to do with the
24 modeling part or the removing of noise, you could say. And
25 then there's a different kind of normalization which then

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1 happens in the scoring process. So two different kinds of
2 normalization. They are both called normalization.

3 Q Is there a normalization process that occurs using
4 something called a reference population?

5 A Yes. When you're testing, you add these reference
6 population that contains the acoustic features similar to
7 the known voice. First, you select this subset of the
8 reference population which is huge. And those should best
9 reflect the same conditions as the ones in the known sample.
10 And you get a scoring and you get a quality measure of that
11 back from Batvox, how well it -- how suitable this reference
12 population seems to be.

13 Q Just backing up a second. The reference population is
14 made up of many other audio recordings?

15 A Yes.

16 Q Okay. And do you select certain recordings to input
17 into Batvox based on the acoustic and voice characteristics
18 of the known sample?

19 A Yes. So many, many, many. Then I let the system
20 select the 45 closest, which is the subset, the optimal
21 subset, of the reference population.

22 Q So of this giant reference population that you've put
23 in, Batvox does something to refine this down to, you said,
24 45?

25 A Yes.

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1 Q Okay. And those 45 are what? How do they relate the
2 known sample?

3 A They are the most similar by scoring.

4 Q Meaning, that the 45 are the most acoustically similar
5 to the known samples?

6 A Yes.

7 Q And by comparing the known samples statistical model
8 and the reference population, what does it tell you about
9 the voice and acoustic characteristics of the known samples?

10 A I don't understand the question.

11 Q What is the point of comparing the known statistical
12 model with the reference population?

13 A It's to be able to normalize the scores that you get in
14 the next process, which is scoring the unknown against that
15 subset of the reference population. And that will give you
16 the distribution of scores for the inter-voice probability.

17 Q So the comparison of the known sample model against the
18 reference population gives you information about the
19 specific features of the known sample?

20 A Yeah. They are as similar as they can be from this big
21 set, yes.

22 Q Is the unknown test file or the unknown sample also
23 compared against the reference population?

24 A Yes. That's what I was saying. That will give a
25 score, space distribution of scores that will explain the

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1 probability of finding the voice within different voice.

2 Q Is this the inter-variability that you mentioned just a
3 second ago?

4 A Yes.

5 Q And is inter-variability showing you the differences
6 and similarities between those single unknown test files and
7 the larger reference population?

8 A The 45 in the subset, yes.

9 Q The 45 reference population?

10 A Yes.

11 Q All right. Moving down the steps of Batvox.

12 At some point after you compared both the known
13 and unknown files against the reference population, is there
14 also a time when you compare files against something called
15 an impostor set?

16 A Yes. To further normalize the scores. And those are
17 the scores within the model, you score. So if you have
18 several recordings as in this case, there is a scoring
19 process within the model to calculate the distribution of
20 scores for this intra-variation. Those scores can be
21 further normalized by scoring them against an imposter set.

22 And the imposter set will have the same acoustic
23 characteristics as the unknown sample so that you could get
24 an idea of the scores that the known model will have against
25 an unknown set of recordings.

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1 Q So the reference population is made up of 45 samples
2 that are similar to the -- similar acoustically to the voice
3 characteristics of the known samples?

4 A Yes.

5 Q But by contrast, the imposter set is made up of samples
6 that are similar acoustically and to the characteristics of
7 the voice in the unknown sample?

8 A Yes.

9 Q Is it fair to say that the impostor set and the
10 reference population are proxies for all voices in the
11 world?

12 A Yeah. Reflecting the case at hand.

13 Q Understanding that they're refined by what the acoustic
14 characteristics are of the known and unknown sample, are
15 they supposed to represent speakers in those same
16 categories?

17 A Yeah. The same acoustic environment.

18 Q So after the samples have been normalized, they have
19 been compared with the reference population, the impostor
20 set, we've gone all the ways that the samples are
21 normalized, at some point does Batvox actually compare the
22 unknown and the known sample model?

23 A Of course.

24 Q Okay. And how is this comparison expressed?

25 A As a likelihood ratio score.

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1 Q Just to clarify, what does the likelihood ratio score
2 mean?

3 A So the score that you get between those, that score is
4 placed somewhere in this shark of the other score
5 distributions of the inter-variation and the intra-variation
6 we have been talking about. That is the graph that was
7 shown. So the score.

8 So we know something about score distributions for
9 both probabilities, and then we have the actual score in
10 this case. And that is placed somewhere in the scale. And
11 then you have to take the ratio of those two probabilities
12 of it being found within the inter-variation and being found
13 within the intra-variation, the ratio between that and the
14 likelihood ratio.

15 Q So at its most simplistic level, the likelihood ratio
16 tells you whether the samples, the scores of that
17 comparison, mean that the sample come from the same speakers
18 or come from different speakers?

19 A Yes.

20 Q On Friday you were also asked by the Court whether the
21 effect of a time gap between samples would affect the
22 ability to analyze the samples. Are you aware of any
23 studies that have looked at the effect of comparing samples
24 that are recorded over different time periods?

25 A Yes. I remember at least one study by Herman Kunzel

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1 who used to be the head of the department for speech and
2 audio analysis at BKA in Germany as well. He is currently
3 still working as a professor in phonetics and also doing
4 casework to some extent using Batvox.

5 So in that study, he tested male speakers, I
6 believe it was, with 11-year difference between the
7 recordings, up to 11 years within the different recordings,
8 and was only for one voice that he found any kind of
9 different likelihood ratio, significant change in likelihood
10 ratios in comparison.

11 Q So in this study, the samples were recorded, the space
12 between the samples recording was ten years?

13 A Yeah. Something like that.

14 Q And what was Mr. -- Dr. Kunzel's opinion as to the
15 effect of this ten-year difference in time between one of
16 the recordings and the other on the ability to run automated
17 voice comparison?

18 A He only found one likelihood ratio that decreased
19 significantly for one voice. Otherwise, it didn't make any
20 difference in the comparisons that he made.

21 Q And why is that? Can you explain for the Court why a
22 person's voice becomes stable at a certain age.

23 A Yeah. So if you listen to voices, it's obvious that
24 children's voices sound different. And then you know when
25 you get to adolescence, for male speakers especially the

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1 vocal cords will grow extremely quickly and that's why these
2 problems with like pitch falls and tops that we can't really
3 control the voice.

4 You probably all have experienced hearing
5 teenagers, male teenagers, trying to speak and have these
6 glitches in their pitches. That's because the vocal cords
7 are growing so fast. And then when you have finished
8 growing, though, the voice stabilizes in adolescence. And
9 when adulthood, it remains rather stable until you get very
10 old, unless there is injury directly to the vocal tract
11 somehow or there is drug use maybe or health issues, of
12 course, could affect the voice, yes.

13 (Continued on the next page.)

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1 DIRECT EXAMINATION (Continued)

2 BY MS. SALICK:

3 Q So for an adult male, after completing puberty, the
4 adult male voice is stable until he reaches old age?

5 A Yeah, that's what the research shows.

6 Q Unless any of the things that you mentioned; injury to
7 the voice box itself or vocal tract itself or other
8 environmental --

9 A Yes. One of my friends in the phonetic society in
10 Sweden, she did her thesis on age and voice and speaker
11 features, as well. She was trying to synthesize voice
12 differences. And it's very difficult to synthesize a voice
13 differences for one speaker, for example, when -- between --
14 when in adulthood, between 20 and 50 years of age, but 60,
15 but then when you become older, we seem to speak slower, for
16 example, and there are some features added to it when we get
17 older. So you could synthesize it. It was hard for her to
18 synthesize ages between 20 or 60 or 70 something like that,
19 and then it was easier for people to perceive, oh, that
20 seems like an older voice.

21 Q So in that study from 20 to 60 the voice was stable,
22 and after age 70 you could notice differences?

23 A Yeah.

24 Q Mr. Lindh, during your testimony on Friday, you stated
25 that using your ordinal scale to express conclusions, most

J. LINDH - DIRECT - MS. SALICK

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1 of your results occur on the positive range, the zero to
2 four range. Do you remember that testimony?

3 A Yes. Yeah. Yes.

4 Q And do you remember approximately how many in -- I
5 believe you said you've done between 350 and 400 forensic
6 analyses. How many times in those analyses did you come up
7 with negative results, results in the zero to negative four
8 range?

9 A Well, if you say zero, then it increases heavily, but
10 if we use the minus, it's only around 20 percent.

11 Q So in the negative range, which would indicate that the
12 speakers are not the same?

13 A Yes.

14 Q Before you received the samples, the audio samples, do
15 you know if the National Forensic Center, which is the
16 center that supplies you with all voice comparison analyses
17 in Sweden, does anything to evaluate or reject audio
18 samples?

19 A Yes, they do their own screening first, and their
20 screening process has increased over the years. They get
21 better in knowing what to send to us.

22 Q Do you know, do you have an estimate as to the
23 percentage of audio files that the National Forensic
24 community rejects will not even send to you for analysis?

25 A An estimate from them, from our meetings in November,

J. LINDH - DIRECT - MS. SALICK

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1 it's around 50 percent of the case requests.

2 Q So if the total case requests that are sent to the
3 National Forensic Center, they reject -- you will never see
4 50 percent of those cases?

5 A No. It will be -- audio, like, in the Zimmerman case,
6 screaming people in the back or, yeah, stuff like that, SOS
7 calls with someone screaming in despair, or those kinds of
8 recordings are normally screened off immediately.

9 Q So after the National Forensic Center excludes
10 50 percent of the samples it's been providing?

11 A Yes.

12 Q And provide you with certain samples to run for your
13 examination --

14 A Yes.

15 Q -- do you also take any measures to further screen out
16 bad samples?

17 A Yes. We do have to do another screening from our side,
18 and also give an estimate and a timeframe and deadlines for
19 when we're completing a case, as in this case, the
20 preliminary screening it's called. And then we exclude
21 another ten or 20 percent of cases.

22 And the most common thing is the -- especially
23 when you receive an intercepted phone call, it will be that
24 some of them can't be used at all.

25 Q So the reduced percentage that you receive from the

J. LINDH - DIRECT - MS. SALICK

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1 National Forensic Center, you further reduce samples that
2 you determine are not a sufficient quality to run your
3 evaluation?

4 A Yes.

5 Q Does the National Forensic Center ever ask you to
6 compare voice samples that they do not believe originated
7 from the same person?

8 A No.

9 Q So the samples you are receiving, there is always a
10 suspicion that they came from the same person?

11 A I think, yeah, we discussed this in November. And of
12 course they receive -- you have some investigating officers
13 who would just drop a whole bunch of intercepted phone calls
14 on their desk. And then they would have to sort out, in the
15 -- and talk to the investigating officer about their
16 hypotheses and so on, because otherwise you would end up
17 comparing male and female voices and, you know, nothing that
18 would be an agreement between prosecution and defense often,
19 for example, so there would be two hypotheses stated and
20 things sorted. So it would make the analysis more
21 efficient, of course, also, and reduce costs, of course.

22 Q So given everything that we just discussed, why is it
23 -- what accounts for the fact that 80 percent of your
24 forensic analyses are on the positive scale?

25 A It's probably this.

J. LINDH - DIRECT - MS. SALICK

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1 Q Everything that we just discussed; the fact that the
2 NFC screens out 50 percent of its samples, you further
3 refine and NFC would never provide you with a sample of
4 someone they did not even think remotely was originated from
5 the same speaker?

6 A Yes.

7 MS. SALICK: Your Honor, the government has no
8 further questions on direct examination.

9 THE COURT: I normally take the attorneys as they
10 are listed on the indictment. Do you want to begin?

11 MR. STERN: I do, yes. If you were looking at me,
12 I do.

13 THE COURT: No, your client isn't the first
14 person, Ms. Kellman is.

15 MR. STERN: Oh, I think we agreed that I'm going
16 to begin, if that's okay with you.

17 THE COURT: Yes, that's fine with me.

18 MR. STERN: Thank you. Judge, can we have a
19 five-minute break before we begin?

20 THE COURT: Yes. In fact, let's take a ten-minute
21 break.

22 MR. STERN: I'm easy, Judge.

23 THE COURT: All right. Recess for ten minutes.

24 (Proceedings were recessed and recalled.)

25 (Honorable Sandra L. Townes takes the bench.)

PROCEEDINGS

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1 MS. SALICK: Your Honor, may I raise one issue for
2 the Court's attention.

3 THE COURT: Wait for the defendants to come out.
4 (Pause.)

5 THE COURT: The defendants are present and counsel
6 is also present. Mr. Lindh is still on the stand, still
7 under oath.

8 Yes?

9 MS. SALICK: Your Honor, just for the Court's
10 attention, Mr. Lindh has a flight out of JFK today --

11 THE COURT: I read that.

12 MS. SALICK: -- requiring him to leave here at
13 2:30, if possible. We're looking into other flight
14 arrangements, but hopefully, if we can end cross by that
15 time, he'll able to make his personal and professional
16 obligations on time.

17 THE COURT: Well, I mean, we have to see how this
18 works out. Mr. Stern?

19 MR. DeMARCO: My cross-examination will be very
20 short, don't worry.

21 THE COURT: Why are you crossing?

22 MR. DeMARCO: I'm not, Judge.

23 CROSS-EXAMINATION

24 BY MR. STERN:

25 Q Good morning, Mr. Lindh.

J. LINDH - CROSS - MR. STERN

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1 A Good morning.

2 Q Mr. Lindh, you've spoken several times now about the
3 350 to 400 assignments you had from the NFC, right?

4 A Not only the NFC.

5 Q And of those, have all of those been voice
6 identification?

7 A No, some of them have been disputed utterance cases.

8 Q I'm sorry?

9 A Disputed utterances cases.

10 Q For example, you worked on a case where there was a
11 question whether the word was "Tim" or "them"?

12 A Oh, yeah, you read it actually. Or maybe Dr. Morrison
13 informed you that we worked on that.

14 Q So how many cases were there like that out of the cases
15 you did, that were not voice identification?

16 A Not more than ten.

17 Q So almost every one that you've done has been voice
18 identification?

19 A Or speak comparison. Comparison is a better word than
20 identification.

21 Q What's the word that I should use?

22 A Comparison.

23 Q Speech comparison?

24 A Speaker comparison.

25 Q Okay. And you've talked some about Dr. Morrison while

J. LINDH - CROSS - MR. STERN

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1 you've been on the stand too, right?

2 A Yes.

3 Q And he's a person you've written articles with?

4 A Um-huh.

5 THE COURT: Yes?

6 THE WITNESS: Yes.

7 THE COURT: Just a moment. You must answer yes or
8 no.

9 THE WITNESS: Yes.

10 Q And I take it a person for whom you've got some
11 respect?

12 A Yes.

13 Q How many articles have you written with him?

14 A Oh, three or four maybe.

15 Q And do you consider him to be part of the community of
16 people who do speaker comparison?

17 A I don't think he has done basically any casework, if
18 that's what you're asking.

19 Q So that's not what I'm asking.

20 I'm asking if you consider him part of the
21 community of people who do research in this area?

22 A Oh, yes.

23 Q And a well-respected member of that community, right?

24 A Yeah.

25 Q Now, you were asked towards the end of this examination

J. LINDH - CROSS - MR. STERN

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1 today about the likelihood ratio that Batvox creates. Do
2 you recall that?

3 A Yes.

4 Q And you said it tells you if that sample comes from the
5 same speaker or a different speaker. Do you remember giving
6 that answer?

7 A No, that's not entirely correct. How much more likely
8 it is to find the score, given that it's the same voice
9 compared to a different voice.

10 Q Is that the answer that you gave when the government
11 asked you that question?

12 A I hope so. Or maybe I shortened it, because it's a
13 very long answer. Sorry in that case.

14 Q Now, you talked about all of this material that goes
15 into imposter sets and reference sets and all those
16 different things that help Batvox do its job, right?

17 A Yes.

18 Q And do you know the content; that is, the actual
19 language spoken by or place of origin or timbre of voice or
20 anything like that of the thousands of speakers contained in
21 those Batvox -- I'm going to call them files -- that might
22 be the wrong word -- what is the right word for those
23 things?

24 A It depends. Are you talking about the Universal
25 Background Model?

J. LINDH - CROSS - MR. STERN

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1 Q Well, right now I'm talking composite sets and
2 reference sets.

3 A I know what's in there, yes.

4 Q And so how many Somali speakers are in there?

5 A Not many.

6 Q About how many Somali Swedish speakers are in there?

7 A A few, not many.

8 Q Do you know as a matter of percentages how many there
9 are?

10 A Less than one percent.

11 Q Do you know as a matter of raw numbers how many that
12 would be?

13 A Between ten and 20, I'm guessing.

14 Q So --

15 A It's a ballpark.

16 Q So if you wanted a group 45 people who were Somali
17 Swedish speakers, the 45 closest, you probably couldn't get
18 that from the reference set in that Batvox, could you?

19 A No. I would have to go back and record that in that
20 case, yes.

21 Q And I take it, you didn't do that, right?

22 A No.

23 Q Now, is language a factor that -- I'm going to say
24 Batvox considers -- I know it's not a human being, but it
25 takes into account or whatever words were used, that Batvox

J. LINDH - CROSS - MR. STERN

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1 uses when it's deciding who to compare to whom? They use
2 language as one of those factors?

3 A You can use that in the method tagging, if that's what
4 you mean. But there are studies explaining that the
5 language content does not make the result any different.

6 Q You mean it has a way you can do it, but it doesn't
7 make a difference?

8 A Yes.

9 Q And did you use it?

10 A No. While I had the -- they are all tagged. No, I
11 used all of them in this case.

12 Q Every one?

13 A Yes, everything I had with the acoustic properties.

14 Q And was there an option to use Swedish Somali?

15 A Swedish. There is no type in Swedish Somali.

16 Q Okay. Now, you talked about the UBM, and that's
17 different than what we're just talking about, right?

18 A Um-huh.

19 THE COURT: Yes?

20 THE WITNESS: Yes. Sorry.

21 Q And in that, do you know the percentage that -- that is
22 also, I take it, voices of many, many people?

23 A Yes.

24 Q In the thousands I think you said, right?

25 A Yes.

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1 Q And do you know the percentage of that UBM that has
2 Swedish Somali speakers in it?

3 A No, that's provided by Agnitio in the software.

4 MS. KELLMAN: I'm sorry, I didn't hear the answer.

5 THE WITNESS: That is within the software, the
6 UBM, so I don't know that.

7 MS. KELLMAN: Thank you.

8 Q And you have no way of knowing that?

9 A Maybe if I asked Agnitio.

10 Q And if it wasn't -- let's say there were no Swedish
11 Somalis, I'm not saying that's true, but let's say that's
12 the case. Would there be a way to augment it so there were
13 Swedish Somalis in the UBM?

14 A I don't quite understand that question.

15 Q That might be my lack of understanding, so let me ask
16 you a different question.

17 A Okay.

18 Q In this UBM, there are speech of many, many different
19 people; is that right?

20 A Yes.

21 Q So there could be, for example, Swedish speakers,
22 right?

23 A Yes.

24 Q English speakers?

25 A Yes.

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1 Q Spanish speakers?

2 A Yes.

3 Q Men?

4 A Yes.

5 Q Women?

6 A No.

7 Q Just men?

8 A It's a different UBM, the two.

9 Q So out of all of those speakers, you have no way of
10 knowing or you don't know as we sit here now, anyway, if any
11 of them spoke, first language Somali, second language
12 Swedish?

13 A No, I cannot know it. No.

14 Q Now, you also said at one point in answer to a question
15 you said, "it's just like you would in DNA or fingerprint."
16 Do you recall that answer?

17 A Yes.

18 Q Now, when you're using Batvox, and I'm using that
19 because that's the one you used, but I take it any of these
20 systems, what you get is a number, right?

21 A Many numbers.

22 Q But in the end you get a likelihood ratio?

23 A Yeah, from the scoring.

24 Q And does anything else print out other than the
25 likelihood ratio?

1 A You mean -- are you referring to the figure? I'm not
2 sure what you're referring to.

3 Q Well, you put in information. You put in all the stuff
4 you talked about and you get a result?

5 A Yeah.

6 Q In what form is that result?

7 A It's the figure that is shown. So the dispersion of
8 the scores for the inter-voice probability and the
9 intra-voice probability. And then it shows the score for
10 the actual test, and where it ends up in all these
11 dispersions of scores.

12 Q And from all of that, they get a likelihood ratio?

13 A Yes.

14 Q Now, when you were talking about -- and, you know, I
15 hope, but I'm telling you, you are free to correct me when I
16 say things that are wrong, okay?

17 A Okay.

18 Q You talked about Batvox -- I'm sorry.

19 Do you recall talking about something that
20 evaluates the vocal tract?

21 A Are you referring to Mel Frequency Cepstral
22 Coefficients?

23 Q I think so, yes.

24 A Okay.

25 Q When you say that, you don't mean that it actually

1 recognizes a structure of an individual or a type of vocal
2 tract, do you?

3 A It reflects the difference sections of the vocal tract
4 acoustics in the speech signal.

5 Q Does that mean it reflects the physical dimensions of
6 the vocal tract?

7 A To some extent, that's why it's called the voice
8 biometric.

9 Q Well, were you familiar with the things that were sent
10 to us; the defense, over the weekends?

11 A You mean the simplification (phonetic) that I did?

12 Q And the materials that accompanied it?

13 A Yes, I've seen it.

14 Q One of them was by someone named -- and I may say the
15 name wrong, Niko Brummer. Do you recall that?

16 A Yeah, Brummer.

17 Q It was automatic text independent speaker recognition?

18 A Yes.

19 Q And is that something that you think is a good piece of
20 work?

21 A Yes. He is the head scientist at Agnitio and has done
22 a lot of research.

23 Q And well-respected in your field, right?

24 A Yes.

25 Q Well, doesn't he say in that document that we were

1 sent, current speaker recognition technology does not infer
2 the physical dimensions of vocal tract from the MMFC
3 analysis; instead, is directly models the MFCC's." Is that a
4 quote from, I take it, Dr. Brummer?

5 A I don't know it by heart, the text of course, but
6 that's possible.

7 Q Okay. Now, you've testified for quite some time now
8 about Batvox and how it functions. And is it your
9 conclusion from all of the work you've done, that Batvox is
10 quite reliability?

11 A That depends on what kind of quality the audio you
12 receive is in, of course. That's a short answer to that.

13 Q That's a good answer.

14 A Okay.

15 Q You've referred to Batvox's core technology. Is that
16 the same as Batvox?

17 A Without the interface. The interface meaning,
18 something written in Java code that gives you a window where
19 you can drag and drop files, instead of -- for example, when
20 I was using Alize software, I would have to scrape
21 everything and write my own code to make things work in a
22 certain way.

23 Q Now, are all microphones the same?

24 A Of course not.

25 Q There are very high quality ones, right?

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1 A Yes.

2 Q Very low quality ones?

3 A Yes.

4 Q And to say something is a lapel mic doesn't tell you if
5 it's high or low quality, does it?

6 A No. There are different quality lapel mics.

7 Q And is it fair to say the conditions; that is, the
8 conditions of the recording device, the conditions in the
9 surrounding environment, all of those things can affect the
10 error rate; is that fair to say?

11 A Yes.

12 Q And it's also fair to say that mismatched conditions
13 are different than matched conditions?

14 A Yes.

15 Q Now, the lapel mic that you saw in the video, do you
16 know the make of that lapel mic?

17 A No.

18 Q Do you know if it is high quality or low quality?

19 A I can only evaluate it from the audio that I can hear
20 in the recording, of course, and also by the looking at the
21 spectrogram and seeing what sampling rates the recording was
22 in, because that would also effect the quality.

23 Q And is it a high or low quality, lapel?

24 A So, as stated in the report, it's a high quality
25 recording.

1 Q And are you familiar with error rate testing done
2 comparing lapel mics to cell phones?

3 A Only the evaluations internally I have done myself.

4 Q And those have never been released?

5 A Nope.

6 Q Now, I want to talk to you for a moment about peer
7 review. Peer review is a well-known mechanism in the
8 scientific community, isn't it?

9 A Yes.

10 Q And peer review is a mechanism by which studies or
11 other information is released to the whole scientific
12 community, right?

13 A Yes.

14 Q And other scientists see if they can replicate your
15 results, right?

16 A Yes.

17 Q See if there is any errors in your results, right?

18 A Yes.

19 Q But that can't be done, I take it, with the test you
20 say you've done, because they're not released to the general
21 scientific community?

22 A No.

23 Q No, it cannot be done or yes, it can?

24 A No, it cannot be done, because as I stated before,
25 material used is classified.

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1 Q So for that testing, we have to just take your word for
2 it, right?

3 A Yes.

4 Q Now, you talked some about acoustic analysis, and I
5 hope I say it right, formant analysis?

6 A Yes.

7 Q Right? Do you recall that?

8 A Yes. Yes.

9 Q And in this very case, you did formant analysis, didn't
10 you?

11 A Yes, something called long-term formant analysis.

12 Q But, really, the truth is -- I don't mean you're not
13 telling the truth, I mean in your report --

14 A Yes.

15 Q -- you don't really rely on the formant analysis at all
16 in your conclusion, do you?

17 A Very little.

18 Q I mean, you say about it as to the first hypothesis, we
19 get the highest rank; however, the range of scores gives no
20 distinct support, right?

21 A Yes.

22 Q And hypothesis two you say, there is weak support for
23 hypothesis two for the speech in UKS2-1, no support for any
24 hypothesis regarding UKS2-2 due to audio quality, right?

25 A True.

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1 Q And for three, you say no support for hypothesis three
2 or alternative hypothesis three, due to small score ranges?

3 A True.

4 Q So it would be fair of me to say that while you talked
5 a lot here about what formant analysis is and whether or not
6 it's useful or not useful, it was not really useful to you
7 in the conclusions that you reached in this case?

8 A Very little.

9 Q Now, you also talked some about error rates, right?

10 A Yes.

11 Q And error rates are something that you don't really
12 believe in; is that right?

13 A It's a measure that you can use for scientific
14 research, yes.

15 Q Well, do you use them or not?

16 A Yes, I use them sometimes.

17 Q And do you think they have value?

18 A Yes, it does say something. Yes.

19 Q And do you have error rates for the mismatch of a lapel
20 microphone and a cell phone when using Batvox?

21 A Only the ones from the tests I conducted myself.

22 Q The secret --

23 A The secret notes, yes.

24 Q And is there a difference in your community, that is
25 the community of speech recognition or -- you know, I might

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1 use the wrong words for that. You know what I mean, right?

2 A Yes.

3 Q Is there agreement in your community on the value of
4 the use of error rates?

5 A Do you mean -- maybe you have to clarify that question.

6 Q Well, I mean, you said, "I think it's better to express
7 things in terms of probabilities," right?

8 A Yes.

9 Q Does everyone agree with you about that?

10 A There are some people who do not use automatic systems
11 at all, I believe. Those are very few still, at least in
12 Europe. I'm mostly referring to Europe. And they more
13 express some kind of opinion in this possibility scale, yes.

14 Q Okay.

15 A Is that an answer to your question?

16 Q I think so.

17 A Okay.

18 Q So now you've talked about your experience with these
19 cases and these types of cases, right?

20 A Yes.

21 Q Did you receive training in the United States?

22 A Nope.

23 Q One second. I'm sorry.

24 (Pause.)

25 Q I'm sorry. Let me go back for one minute, if I could.

1 The consensus that you talked about, about
2 probabilities and error rates in Europe, is that the same
3 consensus in the United Kingdom?

4 A They are a different use. But the majority, and I
5 think almost all of them have some kind of position
6 statement that they -- most of them have signed.

7 Q That is different than what you use or believe in?

8 A Yes. And I am actually aware of -- so the major
9 laboratory and the people that have done most cases is, of
10 course, the people at JP French Associates, Peter French,
11 Professor works. And they are, actually, this summer
12 presenting a new way of reaching conclusions, both where
13 they use automatic systems and also a probability scale that
14 looks almost identical to the one the Swedish NFC is using,
15 but it has more scale levels, as far as I remember.

16 Q And how about in the US, is there agreement on that
17 subject in that issue in the United States with Europe?

18 A The only person I -- that the USA -- I'm not an expert
19 in this area actually. I would probably refer to
20 Dr. Nakasone or Dr. Wayman on that matter.

21 Q Okay. So you weren't trained in the US; I asked you
22 that already, right?

23 A Nope.

24 Q And you said you testified something like 50 times,
25 right?

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1 A As in court, yeah.

2 Q And has any of those been in courts in the United
3 States?

4 A Nope.

5 Q Neither federal nor state court?

6 A Nope. I only deal with the Swedish mostly, so...

7 Q And about 90 percent of the work that you do is for the
8 police in Sweden, the NFC; is that right?

9 A NFC, yes. It's different. It's not the police. It's
10 its own government agency.

11 Q Okay. How many other voice identification experts are
12 there in Sweden?

13 A That do casework?

14 Q Yes.

15 A I think we are two, but I am the only one who gets
16 casework from NFC.

17 Q Who is the other person?

18 A She works as, I believe, for a company called Sprakab,
19 or something similar, who mostly do language analysis, like,
20 so in asylum cases, they do language determination of origin
21 or something like that it's called. Trying to look at the
22 language of the asylum speaker. And she also does some
23 forensic cases, yes.

24 Q Now, you talked about a colleague that you did the work
25 with?

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1 A Oh, yes.

2 Q Who is that colleague?

3 A He's employed by the same company as me, so...

4 Q So Voxalys is your company?

5 A Yes.

6 Q So when you say he's employed by the same company as
7 you, he's employed by you?

8 A Yes.

9 Q Who is that person, what's his or her name?

10 A Joel.

11 Q Joel?

12 A Akesson.

13 Q And I'm going to butcher his name, I'm sure, does
14 Mr. Akesson have the same kind of credentials that you do?

15 A Nope, he has a degree in linguistics, I believe, with a
16 specialization in phonetics, and is also an audio engineer
17 with the many years experience in the music industry.

18 Q Does he do forensic reports the way you do?

19 A No. He's only working together with me, so he will do
20 some assessment and then hand that over to me, so I am the
21 one responsible.

22 Q And then you go over it together?

23 A Yes. To some extent, yes.

24 Q Wait a minute. I messed up my computer somehow.

25 A Okay.

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1 Q Now, you said that your laboratory was inspected by the
2 NFC, right?

3 A Yes.

4 Q Is there an accreditation process in Sweden?

5 A I actually couldn't answer that. I think the NFC has
6 to answer that; they have something like that.

7 Q They have accredited you?

8 A In their own lab or are you talking about companies --

9 Q Any kind accreditation in Sweden?

10 A I couldn't answer that. You will have to ask the NFC,
11 probably.

12 Q I'm sorry?

13 A Probably.

14 Q But you're not aware of it?

15 A No.

16 Q Is there an accreditation process in Europe?

17 A No, not currently. So that's one of the -- what I was
18 -- when we were talking about ENFSI group, he's currently
19 work on guidelines for semiautomatic speaker comparison.

20 Q So that's something that still has to be worked out?

21 A Yes. It's still on-going work, yes.

22 Q And do you know if there are accreditation groups in
23 the United States?

24 A No, I don't know.

25 Q In your lab, do you have something called a quality

1 manual?

2 A Yes, you can say that.

3 Q And is it in writing?

4 A To some extent, yes.

5 Q When you say "to some extent", what do you mean?

6 A There is a protocol that we have to follow, and the
7 template of it is acknowledged by the NFC.

8 Q A written protocol of some sort?

9 A Yes.

10 Q Did you write that or did NFC write it?

11 A I wrote it and it was approved.

12 Q You wrote it and showed it to them and they said okay?

13 A Yes.

14 Q Do they have someone else who does the kind of work
15 that you do?

16 A No, that's why they bought us, subcontracted us.

17 Q So you showed it to people with no knowledge of the
18 work that you do to see if --

19 A They have people working in audio, but no one working
20 in forensic speech comparison.

21 Q Do you have a system for control material that you are
22 given?

23 A Yes.

24 Q What is that?

25 A So it goes through the NFC first, controlling -- they

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1 do different things, like, audio enhancement, but they would
2 always have to give me, for example, the original or as
3 close to the original as they can come, and they have to
4 report that to me or to our lab. And they also do some --
5 consistently checking for whether it's edited or not.

6 Q If the recording is edited?

7 A No, the audio.

8 Q Oh, if the audio that they provide you is edited?

9 A Yes.

10 Q How do they know that?

11 A They have many different processes, I'm not an expert
12 in that area.

13 Q So you can't tell if things were edited or not?

14 A Yes, I can do that kind of investigation too, of
15 course, look at many different things.

16 Q So when you said a minute ago you're not an expert in
17 that area, are you or not?

18 A I would refer to the NFC, because I think they do that
19 better than me, but...

20 Q Okay.

21 A I know a lot about it.

22 Q Now, you discussed how you began reviewing this
23 material in 2011, right?

24 A Yes.

25 Q That's when it was provided to you by a detective

1 inspector of the Swedish Security Service?

2 A Yes.

3 Q And in your report, the materials labeled 2.1 in the,
4 I'm going to refer to it as a graph or grid, are the
5 materials that you were given by the Swedish Security
6 Service; is that right?

7 A May I see the report.

8 Q Yeah.

9 MS. SALICK: Your Honor, may I provide the witness
10 with a copy?

11 THE COURT: Yes.

12 MR. STERN: That would be great. Thank you.

13 THE WITNESS: It's easier, so we can refer to the
14 same thing.

15 MR. STERN: I think that's a very good idea.

16 THE WITNESS: But this is the new one. I think
17 you are referring to the 2011 one.

18 BY MR. STERN:

19 Q No. No.

20 A Oh, okay.

21 Q I'm talking about -- I want to make sure we're talking
22 about same two, that's all.

23 So in that graph, which is on page five, the
24 materials in the Section 2.1, are those the materials that
25 you were given back in 2011?

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1 A Oh, yes. Yes.

2 Q Okay. That was the only thing I was asking you about.

3 A Now I understand.

4 Q And that's the report -- and you were also given a
5 video; that in this same graph or --

6 A The table.

7 Q The table is referred to as material 1.1?

8 A Yes.

9 Q Okay. I'm just doing that so we know what the parallel
10 documents are.

11 A Yes.

12 Q Now, at that point you were assisting in their
13 investigation, weren't you?

14 A I don't really understand what you mean by that.

15 Q Well, as far as you knew, there was no case pending,
16 was there?

17 A No, I had no knowledge about the case at all.

18 Q They were investigating the case and asking you --

19 A Yeah, can you compare --

20 Q About two separate --

21 A Yes, can you compare them.

22 Q I'm going to call them documents, but you know what I'm
23 referring to, you mean audio --

24 A You mean audio files?

25 Q Yes.

1 A Yes.

2 Q And you were asked specifically if you could establish
3 conclusively that the person on the phone calls was the same
4 as the person speaking in the video, is that what they asked
5 you?

6 A That's probably how they would put it in writing,
7 because they are not aware of how to put the things in a
8 reasonable -- I mean, in the Bayesian reasoning way.

9 Q Not many people are, are they?

10 A Exactly.

11 Q But the fair answer to that, for that specific question
12 is no, I cannot conclusively make that establishment?

13 A That is true.

14 Q And --

15 A I probably informed them about that and explained it.

16 Q And when you were given this material, you were told
17 that they believed that the video and one of the speakers in
18 the calls were the same person, right?

19 A Yes.

20 Q You didn't make that determination yourself by
21 listening, did you?

22 A Are you referring to the report now or?

23 Q I'm referring to when the Swedish Police, I'm going to
24 loosely call them the police?

25 A They had a suspicion, and I would then help them to

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1 formulate hypotheses that suits their suspicion, and then I
2 would also help them create an alternative hypothesis.

3 Q Well, they specifically directed you to one of the two
4 speakers in the phone call, right?

5 A Yes.

6 Q They didn't say, listen to this and see if one of these
7 two sounds like the guy on the video, did they?

8 A No, because that would mean a lot more work and
9 probably much higher cost, I presume.

10 Q To listen to it and one sounded like it, you would do a
11 lot more work and a lot more cost?

12 A Yeah.

13 Q How many hours would it take you to listen to four
14 phone calls and a video?

15 A It's not like you are listening. I explained earlier
16 about forensic analysis. It takes a long time to compare a
17 whole set of phonetic features, comparing very closely
18 different sets of features in two different recordings. In
19 this case I would have to do it between all of them.

20 Q But the police haven't done that, had they?

21 A Probably they had to listen to it, yes, and they had a
22 suspicion.

23 Q But I'm talking about the whole phonetic linguistic
24 analysis --

25 A No, they probably don't have any linguists, as far as I

1 know. I don't know about people employed at the Security
2 Service.

3 Q So you relied on them when they said, just by listening
4 -- they didn't give you any notes from a phoneticist or
5 anything, did they?

6 A I'm sorry?

7 Q They didn't give you the notes of the phoneticist who
8 reviewed these things?

9 A No.

10 Q They just said we think, having listened to it, that
11 one of these two people is the same as the person on the
12 video, right?

13 A Yes.

14 Q And you accepted that?

15 A No. I helped them formulate a hypothesis and an
16 alternative hypothesis to be able to perform --

17 Q Go ahead. I'm sorry. I didn't mean to interrupt.

18 A No. When they make a request, I always have to help
19 them out to formulate both their hypothesis and defense
20 hypothesis, because they don't know how to do that,
21 basically.

22 Q Did you listen to the second voice at that time?

23 A Probably. Yeah. Absolutely, yes.

24 Q And did you see if he or she or whoever it was sounded
25 like the person on the video?

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1 A Probably.

2 Q And you did that just by listening, right?

3 A Probably.

4 Q So when you said you just only looked at the one, you
5 really did look at both before starting down this path,
6 right?

7 A Probably, but we had some information I think in some
8 document on which channel. So in this case they both were
9 on the one channel, but you would have information on a
10 person on the phone number calling or receiving, in this
11 case.

12 Q Do you have a specifics recollection of that?

13 A That we have that information?

14 Q Um-huh.

15 A Yes.

16 Q And you have documents reflecting that?

17 A No, probably those are only at the Swedish Security
18 Service.

19 Q Now, the DVD or the video that's the subject of this
20 hearing, I want to talk to you a little about that, okay?

21 A I'm sorry?

22 Q I want to talk to you about the video for a little bit.
23 I'm going like this, but that just means the disc.

24 Do you know the source of that video?

25 A What does that mean?

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1 Q Well, was it downloaded from the internet? Was it an
2 actual disc mailed to someone? Was it --

3 A No, I don't know that.

4 Q Okay. Do you know what changes, if any, were done to
5 the images on that video before you received it?

6 A I don't know that.

7 Q Do you know if it was an original or a copy?

8 A No, I don't know.

9 Q Do you know the type of camera used to make it?

10 A Nope.

11 Q And you already said you don't know the type of
12 microphone; although, it was a lapel microphone, right?

13 A Yes.

14 Q Do you know for sure if the picture and the sound were
15 done at the same time?

16 A Nope.

17 Q Do you know the date in which the video was made?

18 A Nope.

19 Q And I think you're aware that there was some filtering
20 effect due to masking, right?

21 A Yes.

22 Q And that means just what it sounds like, the speaker as
23 we all say, was wearing something over his face?

24 A Yes.

25 Q And you've read, I think, some papers addressing the

1 effect of masking, right?

2 A Yes.

3 Q There was a specific paper by someone named Natalie
4 Fausha from the University of York?

5 A Yes. The communication I've had is mostly with e
6 supervisor, Dr. Dominic Watt (phonetic).

7 Q And did you rely on that paper in deciding how much
8 effect filtering might have on someone's speech?

9 A To some extent.

10 Q And it's fair to say, isn't it, in that paper written
11 by Ms. Fausha and someone named Watt -- Ms. Fausha said or
12 Mr. Watt said, they said, "The different masked materials
13 will modify the acoustic properties of the signal by
14 effecting the sound transmission/absorption characteristics
15 to varying degrees." Is that part of what they said?

16 A In the paper probably.

17 Q Yes.

18 A They were investigating that, yes, the different masks.

19 Q The FCG's -- what are FCG's?

20 A I think --

21 Q Oh, I think it's facial cloaking garments. I'm sorry,
22 I should have known from here. It's a standard in your
23 field?

24 A No. No. No.

25 Q The facial cloaking garments are assumed to act like a

1 low pass filter attenuating the level of sound energy in
2 higher frequency bands?

3 A Yes.

4 Q Did they also say FCG's, facial cloaking garments,
5 impose a new level of complexity in the listener's search
6 for perceptual queues in the signal. What does that mean?

7 A So they were mostly looking at how it effects how
8 people perceive different consonants.

9 Q Does that mean also you can't see their lips moving?

10 A Yes.

11 Q And then she said or he says, they say, "We propose the
12 factors in one or two impose significant cognitive demands
13 in audio visual speech perception, impairs eligibility of AV
14 stimuli as anticipated, because of interference with speech
15 production and the acoustic signal compounded by
16 impoverished visual queues."

17 Now when they say "interference with speech
18 production," what do they mean?

19 A So there are two different things. When you perceive
20 how somebody speaks, if you can't see them articulate, it's
21 harder to perceive what they say, okay?

22 And the other thing is --

23 Q What's that? I'm sorry, that's my impoverished visual
24 queues, right?

25 A Yes.

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1 Q What do they mean by speech production, interference
2 with speech production?

3 A That's what I was getting to.

4 Q I'm sorry. Go ahead.

5 A So how tight and how thick the garment was would effect
6 how you could move articulators.

7 Q Your lips?

8 A Lips, for example, yes. And they even have tape that
9 was very hard, hardly tape around your mouth.

10 Q Okay. Now, that video you've seen a number of times,
11 haven't you?

12 A Yes. Well, mostly listen to the audio.

13 Q And is it fair to say that it's generally difficult to
14 compare two very different kinds of speech, one to the
15 other?

16 A Please repeat the question.

17 Q Well, let me give you an example.

18 If someone's an actor in a Shakespearian play and
19 you record that?

20 A Um-huh.

21 Q Is it easy to compare that to talking to his wife or
22 her wife?

23 A Oh, yeah. You mean situational and sociological
24 factors?

25 Q Yes.

1 A That can definitely effect how you speak, yes, to
2 different people and different environments, yes.

3 Q And it's fair to say that the videotape is a kind of
4 performance, isn't that right?

5 A Yes, I think I mentioned that somewhere as well, that
6 it's -- to some extent, a part of it is close to read
7 speech.

8 Q What was the word?

9 A Read.

10 Q Oh, read, r-e-a-d?

11 A Yeah.

12 Q And it's also fair to say, isn't it, that the phone
13 calls appear to be a conversation between two people who are
14 acquaintances or friends?

15 A Yes.

16 Q They don't appear to be read, do they?

17 A No.

18 Q And they don't appear to be a performance of any kind?

19 A Nope.

20 Q And the comparison you did between the calls that we've
21 called 2.1 and the video that we called 1.1, you later
22 reviewed those same calls against that same video, didn't
23 you?

24 A Sorry. Can you repeat that, please?

25 Q Yeah, that's right. I'm referring to the phone calls

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1 that you had in Sweden?

2 A Yeah.

3 Q And the videotape, you had those in 2011?

4 A Yeah.

5 Q And you had those same two pieces of what I'll call
6 evidence when you did this work for the US Government; is
7 that right?

8 A Yes.

9 Q Okay. Now, when you were evaluating this information
10 for the Swedish police, you did, for the most part, the same
11 process that you did three years later for the US
12 government?

13 A Yes.

14 Q You broke them down phonetically?

15 A Um-huh.

16 Q You compared the phonetics from one to the other?

17 A Yes.

18 Q You didn't have Batvox then, you had a different
19 system?

20 A Yes.

21 Q But you fed it through a biometric system?

22 A Yes.

23 Q You got the result, whatever that was, right?

24 A Yes.

25 Q And you have a list of things, and I think you said are

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1 a part of your protocols, right?

2 A Yes.

3 Q And so I'm going to tell you names of things, and you
4 tell me if these were done both in the US and in Sweden;
5 that is, both in 2011 and in 2014. If I name one that was
6 not done in both places, you should tell me, okay?

7 A Okay.

8 Q So did you do phonemic and morphemic/lexical analysis?

9 A Yes.

10 Q Did you do intonation and speech rhythm?

11 A Yes.

12 Q Did you do voice quality?

13 A I believe so.

14 Q Did you do speed of speech?

15 A Probably. I can't remember really the 2011 report. If
16 we had -- because the protocol with the NFC was created
17 later, so I'm not sure about that. I have to look at the
18 2011 report.

19 Q Did you give that protocol to the government by the
20 way?

21 A It's the report, basically. So it's stating all the
22 different factors that you are looking at.

23 Q When you say "the report is the protocol," is there a
24 separate protocol written up by you and approved by the NFC?

25 A It's the report. That is the template that of the

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1 report.

2 Q Okay. So when you say a protocol, what you mean is we
3 always do our reports the same way, and that's the protocol
4 we do all of these things?

5 A Yes.

6 Q Okay. Did you do formant frequencies?

7 A Probably.

8 Q Did you biometric statistical analysis of the voice?

9 A Yes, using Alize.

10 Q Using a different, than you say, in theory or system,
11 right?

12 A Yes.

13 Q And you then fed whatever information you put into
14 Alize instead of Batvox, right?

15 A Um-huh.

16 Q And it came out with a likelihood ratio?

17 A No, it didn't. It doesn't.

18 Q Well, did it come up with a number 232.778?

19 A I can't remember that.

20 Q Well, let me show it to you.

21 A Yeah, that would be easier.

22 Q You know, may I approach for a second, your Honor?

23 THE COURT: Yes, you may.

24 Q It's a long walk up here.

25 A It's far away. (Document handed.) Yeah, I recognize

1 it.

2 Q Okay. And what is that?

3 A It was an attempt by us to use this unimode way of
4 looking at the core distribution. So it was -- yes, it was
5 a way to try and get to a likelihood ratio.

6 Q And then did you convert -- what's the Norgaard Scale?

7 A That's the probability scale provided by the NFC.

8 Q What's it used for?

9 A To express conclusions in forensic.

10 Q Is there a way using the Norgaard scale to convert a
11 number like that into an ordinal number like the NFC used?

12 A Yes.

13 Q And what is that? How does one do that?

14 A There are spans of likelihood ratios. Do you want to
15 know them?

16 Q Well, I don't know need to know them. When you say
17 there are spans of likelihood, I mean, I know these aren't
18 the real numbers, but ten to 20 be a -- 30 to 40 would be
19 something else, right?

20 A For example, yes.

21 Q In this case, if you convert that number that
22 likelihood ratio using the Norgaard scale it comes out to be
23 a plus two; is that right?

24 A Yes.

25 Q And you had done all of these analyses, we talked about

1 phonemic and morphemic or whatever?

2 A Um-huh, yes.

3 Q And the final score in this case on the Norgaard scale
4 was a plus two, wasn't it?

5 A Yes.

6 Q Okay. Now -- I'm sorry, I don't think I was -- I meant
7 the final result that you came up with balancing all the
8 other work that you did within this case, the biometric
9 system, whatever it was, it was the same as the machine had
10 said?

11 A Yes.

12 Q Now, you've talked some about the protocols and you've
13 made clear to me what I didn't understand, that the
14 protocols are really a template for filling out these
15 reports, right?

16 A Yes.

17 Q So do these protocols --

18 A There are other protocols on handling how the audio is
19 handled, for example, between NFC and us.

20 Q You mean, that's like chain of custody stuff?

21 A I don't know exactly what that means.

22 Q That's like, so everyone knows where everything has
23 been?

24 A For example, yes, and how it's encrypted and delivered.

25 Q But that has nothing to do with the testing, does it?

1 A No.

2 Q So have you told us now all of the protocols and
3 guidelines that control your work?

4 A Well, we have the IAFPA guide of practice.

5 Q Okay. And their guide of practice also doesn't tell
6 you how to do your work specifically, does it?

7 A No. It's very general, since it's a worldwide
8 organization.

9 Q Basically tells you to be ethical?

10 A Yes.

11 Q Okay. But the guidelines and protocols that you have
12 don't tell you specifically how to conduct voice comparison,
13 do they?

14 A Only the sense that -- how I have suggested it should
15 have been done, how you should do it is approved, yes.

16 Q So you suggest it, they approve it?

17 A Yes.

18 Q Do the guidelines and protocols you have tell you how
19 to weigh automatic versus human analysis?

20 A Nope.

21 Q Do they tell you whether or not to use likelihood
22 ratios?

23 A Nope.

24 Q Do they tell you how to compare video camera recordings
25 to cell phones?

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1 A Nope.

2 Q Do they tell you how to define a relevant population?

3 A Nope.

4 Q Now, you've talked some about the I think you called it
5 ordinal and verbal probability scale of the -- used to be
6 SKL I guess, but it's now NFC, right?

7 A Yes.

8 Q And that scale is used for many kinds of --

9 A All forensic analysis.

10 Q Yes, exactly. And it was created, wasn't it, for DNA?

11 A I don't know that, but I think in some of his
12 publications, the statistician, he used this DNA for the
13 likelihood ratio response I think to some extent.

14 Q Now, you know in DNA they use a machine, not the same
15 machine, but a different machine and it spits out a graph,
16 right?

17 A Um-huh.

18 THE COURT: You must answer yes or no.

19 THE WITNESS: Oh, yes. Yes. I think I've seen
20 something like that. I'm not an expert at all.

21 Q No, I know, but you've seen them, they're like jagged
22 lines on a piece of paper?

23 A Yes.

24 Q And in fingerprints, there is the actual fingerprint,
25 right?

1 A Well, in fingerprinting, in Sweden, as far as I
2 believe, they -- an automatic system will spit out, like,
3 the ten closest or something like that from a database, and
4 then an examiner would then judge different similarities of
5 swirls and other English terms of these different patterns.

6 Q Well, traits you mean?

7 A And he makes a conclusion in this case.

8 Q So what does the machine you use print out or create
9 that's comparable to the graph that a DNA expert uses or
10 what you're talking about now, the ten fingerprints that
11 come out and are compared by a human?

12 A How it's compared, the graph. You're referring to the
13 graph from Batvox, are you?

14 Q Excuse me?

15 A Are you referring to the graph that Batvox creates?

16 Q I don't know what Batvox makes, I'm asking.

17 A You've seen the graph that it creates. That's
18 equivalent.

19 Q Okay. You began working with the US Government on this
20 case December 3rd, 2014; is that right?

21 A I can't recollect the exact date, but I'm sure
22 that's --

23 Q Somewhere --

24 A -- I'm sure that's correct.

25 Q And the government told you when they believed it was a

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1 person named MY speaking, right?

2 A I think it was -- as far as I can recall, it was quite
3 confusing, because the transcripts had different -- that I
4 saw -- had different names or different acronyms.

5 Q Well, did you create this table that we've been talking
6 about?

7 A Yeah. With the labels, yes.

8 Q And --

9 A But it looks a bit different, yes, from the preliminary
10 screening.

11 Q You created a different table?

12 A Yes.

13 Q Okay. But did you figure out who to put MY next to and
14 who to put AYA next to or were you told who to put it next
15 to?

16 A Yeah, it was according to the transcripts that was
17 explained, so...

18 Q That was provided to you?

19 A Yes. So someone somewhere has an hypothesis.

20 Q So someone -- I'm sorry, were you done?

21 A Yeah. I mean, that someone has a suspicion somewhere
22 of course.

23 Q So someone had listened to these phone calls and marked
24 down for you, I think this is MY, I think this is AYA; is
25 that right?

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1 A Yes.

2 Q And they also told you, and I think the video, that's
3 the real subject of this hearing, is MY?

4 A That's what they're suspicion, yes.

5 Q So going into this, you knew what their suspicion was,
6 right?

7 A Yes.

8 Q And were you given a limit of how much money you could
9 charge to do this case?

10 A Yeah. In the end there was a contract. It took a long
11 time.

12 Q What were you limited to?

13 A I'm sorry?

14 Q What were you limited to?

15 A I actually don't know, but it's in that contract, so I
16 don't know, but it's the limits. I do know what we have
17 sent as an invoice, if that is what you're asking.

18 Q Okay. Well, was it around \$50,000 the amount that you
19 were told you could charge up to?

20 A It's possible. It's very possible.

21 Q And did anyone tell you how you should go about doing
22 this?

23 A You mean how invoices are sent or?

24 Q Who you should compare to who, what you should compare
25 to what?

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1 A Oh, you're talking about background?

2 Q Decisions you should make?

3 A No. No, not decisions to make, but what to compare.

4 Because if you end up comparing everything to everything,

5 we're getting back to, again, that raises how long it will

6 take and it's hard work if there is no suspicion. But then

7 we would also help -- so if you look at preliminary screen

8 there is many more sets of unknown speaker samples. And

9 then you try for the report to diminish that by using a star

10 function so you actually have fewer hypotheses, and thereby

11 making it more readable and understandable to the trier of

12 fact.

13 Q Well, were you given a date by which you had to have

14 this done?

15 A Yes. So we would put a deadline on the preliminary

16 screening.

17 Q And what was your --

18 A For the draft one it was.

19 Q What was your deadline?

20 A Before Christmas sometime, as far as I can recall. So

21 probably -- if you look at the draft one, there is a date on

22 that, that should give you the information.

23 Q That was deadline or that's when you completed it?

24 A That's when I completed draft one, so that date will

25 give you the deadline for graph one.

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1 Q That's what I'm asking. The date on that document is
2 the date that was set as the deadline or did you complete it
3 before the deadline?

4 A I completed it that date of the deadline of graph one,
5 yes.

6 Q And I take it it's fair to say this is the second time
7 you're looking at some of the information, but not all?

8 A Yes.

9 Q It's the second time you're looking at what we call the
10 2.1, so it is the Swedish phone calls, right?

11 A Yes.

12 Q And it's the second time you're looking at 1.1, right?

13 A Yes.

14 Q And you've already examined those and come to the
15 conclusion about three years earlier that on the Norgaard
16 scale there are plus two?

17 A Yes.

18 Q And you're looking newly at phone calls which I'm going
19 to call, in a general way, jail calls, right? Those you've
20 never seen before, right?

21 A No.

22 Q And calls I'm going to call Somali calls?

23 A Okay.

24 Q You know what I'm referring to in that, right, I'm
25 referring to --

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1 A The others that were not provided in 2011.

2 Q Correct, 1.2 and 2.2. Do you see them there?

3 A Yes.

4 Q And did you ever compare any of the AYA's, AYA's to the
5 AYA's or the MY's to the MY's?

6 A If I compared them, yes.

7 Q Yes? Did you ever compare the MY's to the AYA's?

8 A To ask some extent, yes.

9 Q Did you compare AYA to what we've called the video?

10 A So some extent in 2011 that's the other speaker, but
11 then you would actually also use it for some of the
12 normalization.

13 Q Did you make notes of any of those comparisons of AYA
14 to the video?

15 A No.

16 Q Did you make any notes --

17 A Maybe in 2011.

18 Q Yes. Yes. Of comparing -- I'm sorry, you said you
19 didn't compare AYA to AYA, you took their word for it?

20 A I'm not sure what you are speaking of now.

21 Q I'm sorry, 2011.

22 A Say again.

23 Q Did you compare -- well, I think you said you did not
24 compare, I want to make sure I'm right, the calls marked AYA
25 to other calls marked AYA?

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1 A Yes. Yes.

2 Q You did compare those?

3 A Yes.

4 Q Okay. Now, you had instructions from the US
5 government, right?

6 A Yes.

7 Q A set of instructions. And you were told to establish
8 the ratio of how likely it is to find the results of the
9 analysis between the different recorded speakers under
10 different hypotheses. Is that the instruction that you were
11 given?

12 A Yes, with me helping out in formulating that
13 probability, I would assume.

14 Q And that instruction is written the language of
15 likelihood ratio, is it not?

16 A Or Bayesian reasoning.

17 Q And it's an instruction that directs you to come up
18 with a likelihood ratio?

19 A Oh, a Bayesian conclusion I would say more than the
20 likelihood ratio.

21 Q Well, doesn't it specifically tell you how to come up
22 with a ratio of how likely it is to find the results?

23 A Well, in assessed ratio it does. But it's not
24 completely true, because the conclusion is just Bayesian ask
25 expression, not a numeric --

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1 Q Are you suggesting that it does not say ratio?

2 A No, it's very possible, but then it's somewhat
3 incorrect.

4 Q Well, it's not just impossible; it's true, isn't it?

5 A Well, if you say so. Let me see it, yes?

6 Q Don't you have the report up there?

7 A Where do I --

8 Q Take a look at the section?

9 A Oh, okay. I wrote that -- where are you? Can you give
10 me the --

11 Q 1.2 construction, which begins at the bottom of page
12 five.

13 A Oh, yes. Yes. Now I see it, yes. I found it. I
14 found it. Yes. It's true, but that's that is kind of
15 incorrect, I would say, I would have to admit to that.

16 Q So the instructions that you wrote with the input of
17 the Government are what?

18 A Sorry?

19 Q They're not entirely correct?

20 A No, it should be stated more like as a Bayesian
21 conclusion or something like that instead of an actual
22 numerical ratio, yes.

23 Q And, in fact, you never found a numeric ratio, did you?

24 A Only for the automatic part, that's with the focus
25 part, yes.

1 Q Now, do you at all, putting aside the automatic part
2 now, do you at all find likelihood ratios?

3 A I do not understand that question.

4 Q When you do these kinds of investigations, do you
5 generate likelihood ratios?

6 A Do you mean for the other things than the system?

7 Q Yes, other than the automatic system?

8 A To some extent for the acoustic analysis or the formant
9 things that we expressed earlier that we didn't rely very
10 much upon, that one too; otherwise, no.

11 Q Are there people in your field in your scientific
12 community who think the way to do this is, is to generate
13 likelihood ratios?

14 A Dr. Morrison is one of the very few, yes.

15 Q So you think that Dr. Morrison is an outlier in that
16 way?

17 A Yes. We have agreed many times to disagree on that
18 matter. May I expand on that?

19 Q No. Let me ask you another question. Do you know
20 someone named DK Uley (phonetic)?

21 A Oh, yes, he's a statistician working for the Forensic
22 Institute in the Netherlands.

23 Q And what does he think about likelihood ratios?

24 A He loves them.

25 Q He's another proponent of likelihood ratios?

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1 A Oh, yes.

2 Q Those two we've mentioned are not the only two, are
3 they?

4 A No, but what should be said is they are not forensic
5 statisticians, people doing forensic speaker comparison
6 casework.

7 Q Are you saying Dr. Morrison has never done any cases?

8 A Very, very few.

9 Q And how about DJ Muley?

10 A No, he works as a statistician, so he would give input
11 on how to express a conclusion in the Netherlands, but their
12 scale is absolutely not in an area that they use for their
13 conclusions.

14 Q It's very different from the scales you use?

15 A I am not -- I don't know exactly what it looks like,
16 but I'm helping them out doing evaluations now, so I think
17 I've seen something at some point. It looks different from
18 ours, yes.

19 Q Now, you, I take it, create hypotheses based on
20 information the government gave you; is that right?

21 A Yes.

22 Q And one hypothesis you created is -- and I'm talking
23 about hypothesis one now.

24 A Um-huh.

25 Q Can you say that the speech of a known speaker compared

1 to an known speaker originates from the same speaker, is
2 that one hypothesis?

3 A The speech originates from the speaker, yes, that's the
4 first hypothesis.

5 Q Did I read that accurately?

6 A Yeah. Yes.

7 Q And really, you would never say as a scientist or
8 rarely say as a scientist, this speech comes from these same
9 speakers, would you?

10 A No.

11 Q You would state that as a level of confidence that you
12 have?

13 A Bayesian -- well, using Bayesian reasoning gets a
14 conclusion for at least two probabilities and how much more
15 likely one is over the other.

16 Q You don't really use strict Bayesian reasoning, do you?

17 A I have to speak to the probability scale provided by
18 the NFC, and I have been in group discussing how to verbally
19 express it, and that's -- they have updated the scale many
20 times. So, yes, there are some inconsistencies to the
21 Bayesian reasoning.

22 Q And that ordinal system is not strictly Bayesian
23 reasoning, is it?

24 A No, not strictly.

25 Q And you differ with them about best way to state these

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1 things, don't you?

2 A To some extent, yes. I still believe the ordinal scale
3 is very good, but we have long discussions.

4 Q And --

5 A Me and Norgaard, Norgaard who we were referring to, the
6 statistician at NFC.

7 Q And discussions can be had, for example, on whether
8 nine is enough divisions or not, right?

9 A Sorry?

10 Q Whether nine in your scale, not your scale, the
11 Norgaard scale?

12 A Oh, you mean plus four, now I understand.

13 Q There are nine divisions, zero and then four on either
14 side?

15 A Yeah, yeah.

16 THE COURT: Wait. Wait. Wait. My court reporter
17 is trying to take down what you're saying and you're both
18 talking at the same time. She can't do that.

19 MR. STERN: You're right, Judge. I'm sorry.

20 THE WITNESS: I'm sorry, your Honor.

21 MR. STERN: I think it was my fault, not yours.

22 THE COURT: All right.

23 MR. STERN: Anyway, I'll try to make sure it
24 doesn't happen. Sorry, court reporter.

25 BY MR. STERN:

1 Q On that scale there are people who think there should
2 be more numbers; is that fair to say?

3 A Oh, yeah, you can always argue how many levels there
4 should be, yes.

5 Q And was there a specific reason why they arrived at
6 nine?

7 A Yeah. Well, Norgaard some reasons are, you know,
8 historic and domestic, so the Swedish judicial system is
9 very used to this nine point scale, so that is basically why
10 we used nine points.

11 Q But that's not really a scientific reason, that's a
12 traditional reason?

13 A Yes.

14 Q And then the second hypothesis you have is, can you say
15 that the speech of a known speaker compared to an unknown
16 speaker does not originate from the same speaker, right?

17 A Yes.

18 Q And how would you prove that it does not originate from
19 the same speaker?

20 A Oh, you would try to come up with, like, when we were
21 talking about finding all the similarities, and also finding
22 all will differences supporting that probability. And then
23 finding all the similarities from supporting the other
24 probability, and that has to do with both similarity and
25 technicality.

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1 Q Now you're talking about probabilities, but I'm asking,
2 can you ever say it does not come from the same speaker?

3 A No, no, the same with the other hypothesis.

4 Q And the other only way you can do that is if you found
5 the person who said, and you could prove the person, he or
6 she, said, and then you would know it's not from the other
7 speaker?

8 A Yes.

9 Q And that's the only way you could prove -- I'm not
10 talking about probabilities now, but you would prove --

11 A Yes. You are talking about the national match,
12 correct?

13 Q Yes.

14 A Correct.

15 Q All right. Now, in your report you have a footnote
16 it's nominated number five and it's attached to the first
17 alternative hypothesis. Take a look at page six of your
18 report. You know what I'm talking about, right?

19 A Yes.

20 MS. SALICK: Excuse me, which report are you
21 referring to?

22 THE WITNESS: Excuse me, your Honor, can we have a
23 five-minute bathroom break?

24 THE COURT: Yes. We're going to take a
25 five-minute recess.

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1 THE WITNESS: Thank you.

2 (Proceedings were recessed and recalled.)

3 THE COURT: Ms. Salick may we proceed? Your
4 co-counsel is not here, but I did say five minutes.

5 MS. SALICK: May I step outside to see if he's
6 standing outside the door?

7 THE COURT: Yes.

8 MR. ARIAIL: The witness had asked for some
9 coffee. Is that okay if I?

10 THE COURT: Yes. All right. The defendants are
11 all present, counsel, as well as Mr. Lindh, who is still on
12 the stand, still under oath. Mr. Stern.

13 MR. STERN: Thank you, Judge.

14 BY MR. STERN:

15 Q Mr. Lindh, I just want to go back for a minute to ask
16 about something.

17 A Okay.

18 Q We talked about lab accreditation?

19 A Yeah.

20 Q Is Voxalys an accredited lab?

21 A I don't think that term is applicable, no.

22 Q And we were talking about your doing phonetic and those
23 kinds of analyses?

24 A Yes.

25 Q Are there studies of voices, pronunciations, accents,

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1 speech patterns, timbre or anything else to show what
2 percentage of people in a different population share what
3 traits?

4 A Oh, yes. Well, most phonetic and linguistic studies do
5 discrimination analysis of some kind, looking at how well
6 you can discriminate between speakers for a couple of
7 features, not normally all of them, but for some features.
8 But I see what you're getting at, the error rates and all
9 that.

10 Q Have you read such a study for Somali speaking --
11 Swedish speaking Somalis?

12 A As a matter of fact, you mean linguistic studies or?

13 Q Yeah, showing what traits of whatever kind are
14 prominent in that population?

15 A Not when it comes to -- you talk about voice quality
16 and those kinds of things, but when it comes to linguistic
17 straits, that's all. There was a woman at our university
18 who did her speech thesis on Somalian Sudanese, is that the
19 right term?

20 Q I'm sorry.

21 A Sudanese. I don't know how you say that language,
22 Sudan.

23 Q Oh, the language you're talking about?

24 A Yes. She was working on that.

25 Q And was it --

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1 MS. KELLMAN: Sorry, Judge, I didn't hear the end
2 of that.

3 THE COURT: Yes. You have to keep your voice up.

4 THE WITNESS: Sorry, Judge. I'll try to stay
5 closer to the microphone. So there was a woman, she's now a
6 professor somewhere in Africa. She worked at our university
7 and her speech thesis was on, I believe, Somali and the
8 language, I think is called the English, Sudanese.

9 BY MR. STERN:

10 Q I'm really asking you about study of first language
11 Somali, second language Swedish speakers?

12 A Okay.

13 Q Have you read a study of that?

14 A Not specifically, no.

15 Q Now, we were talking when we broke about what is
16 footnote five in your report. Do you recall that?

17 A Yes.

18 Q And that footnote, which is on page six of your report
19 is appended to the first alternative hypothesis, right?

20 A Yes.

21 Q And what it says is, I'm reading it to you, just tell
22 me if I read it correctly, "Here one can add not someone who
23 sounds similar enough to find it necessary to send to
24 forensic analysis," right?

25 A Yes.

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1 Q And by "similar enough" when you say that, do you
2 include in that, someone's accent?

3 A Yes. To some extent, yes.

4 Q Do you include in that the speed of speech?

5 A I guess it's the impression of the person who will
6 sound the material for a forensic request.

7 Q And by that you mean it's not scientific, they just say
8 it sounds to me like these are pretty close?

9 A Yes.

10 Q So it's not the kind of thing that you do?

11 A No.

12 Q Now --

13 A So it could be, yeah. You could have something like
14 someone from the general population believes or something
15 like that, it's just some kind of clarification of that.

16 Q All right. Now, I want to read you a sentence from
17 your report that's at page seven, section 2. I think it's
18 the section under the section, you see, that's marked
19 "additional". It's the third section under two.

20 A Yes. Yep. Trying to, since all these conversations
21 back and forth, I try to add some kind of explanation.

22 Q So first tell me if I read it accurately.

23 A All right.

24 Q It says, "Similarities and dissimilarities observed in
25 the initial data analysis are also judged for typicality or

1 atypicality against the relevant population at large." Tell
2 me what that means?

3 A So the relevant population at large would be that
4 defined reference population for the phonetic linguistic
5 analysis.

6 Q For the what?

7 A For the linguistic and phonetic analysis measure. So
8 there is one there and a different population referred to
9 when you do automatic analysis.

10 Q Well --

11 A Maybe it's confusing in English. Or does population at
12 large mean anything?

13 Q I just might not be smart enough to understand it, I
14 don't know.

15 A It might be my English absolutely, as well.

16 Q But you're saying generally it means the population as
17 defined by the person who is going to evaluate the
18 information?

19 A Yes, through the linguistic and phonetic analysis.

20 Q And in this case specifically what does that mean, the
21 population at large?

22 A It refers to the -- what we defined under the results
23 there, the first general comments.

24 Q Which was what?

25 A So Swedish and Somali speaking community for young male

1 from Stockholm area.

2 Q And when you say that's what you used, is that what you
3 used at every single step in this process, that Swedish and
4 Somali community from Stockholm between whatever ages you
5 said, 20 and 40?

6 A It's a way to be able to somehow conceptualize the
7 typicality in the phonetic and linguistic analysis, yes.

8 Q Okay. Is it fair to say that how we speak is something
9 learned from very early stages in our lives?

10 A Yes.

11 Q And is it also fair to say that a trained linguist
12 should be able to detect traces of that early influence,
13 even when a person becomes fluent in another language?

14 A Not necessarily. Many factors will influence that.

15 Q Like what?

16 A When in time, for example, you acquire a language, you
17 if are you multilingual, for example, such factors, you
18 know, and then the ability of acquiring -- there are many
19 different factors influencing that.

20 Q Are you multilingual?

21 A Then you have to define what multilingual means. I can
22 speak many languages to some extent.

23 Q So you said multilingual, so you define it.

24 A So in that instance I would mean that you are as a
25 native speaker. So if you can communicate in the same -- to

1 the same extent as your native language, so what you
2 communicate.

3 Q So if you could communicate to the same extent, but you
4 have a heavy accent, are you multilingual?

5 A Yeah. I mean, yes, you could be. You could still have
6 a -- there is a different thing between having the ability
7 to speak a language and that you still carry, for example,
8 phonetic traits in your speech while you're speaking, right.
9 So some people -- so this is the thing with the adolescents
10 again. If you have people acquiring the language before
11 adolescents, for example. It's much more common. They are
12 able to acquire the language much better, especially maybe
13 then if you are referring to the phonetic pronunciation and
14 so on. So in Swedish you have the accent one and accent two
15 I've been talking about, that's very difficult to acquire.
16 So someone who would have started to learn Swedish after
17 adolescents has started has much more difficulties acquiring
18 that difference than someone who came before adolescents,
19 for example.

20 Q Okay. You were told by both the US and the Swedish
21 governments that the people they had you investigating were
22 Swedish Somalis, right?

23 A There were both languages present in the recordings,
24 except for the video or -- there were some Arabic there. I
25 think there was some Somali there as well.

J. LINDH - CROSS - MR. STERN

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1 Q Were you told they were Swedish Somalis?

2 A I actually don't remember, if you are referring to
3 2011.

4 Q How about 2014?

5 A Now, I would have been aware of that, yes.

6 Q And you've listened to these tapes, right?

7 A Um-huh.

8 THE COURT: Yes?

9 THE WITNESS: Yes.

10 Q Could you tell from the accents that these were not
11 native Swedish speakers?

12 A Yes, to most extent. But there is subparts of the
13 speech that is very native Swedish.

14 Q And I take it some parts that are not?

15 A Yes.

16 Q And so when you heard these accented parts, you were
17 aware that there were words that they pronounced differently
18 than native Swedes; is that right?

19 A Yes.

20 Q Now, you made some assumptions in your report, didn't
21 you?

22 A Yes.

23 Q So, for example, you assumed that the suspects were
24 living in Sweden in 2002?

25 A Not entirely. I was referring to the numbers that the

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1 thesis I'm referring to is referring to. Did that make
2 sense? So in the thesis I'm referring to, she's referring
3 to numbers from 2002.

4 Q Oh, but don't you say explicitly that you're assuming
5 that the suspects lived in Sweden in 2002? Do you say that
6 or not?

7 A Probably I do. That's, to some extent, incorrect way
8 to express it in that case.

9 Q You have no idea if that's true or not?

10 A No. No. No.

11 Q And the information you got regarding the number of
12 Swedish Somalis was from a dissertation, right?

13 A Yes.

14 Q It was written in when?

15 A Oh, can I look?

16 Q Sure.

17 A That's 2010 or something like that, I think. When was
18 it? So it's from 2009.

19 Q And the author of dissertation is a woman, right?

20 A I think so, yes.

21 Q And you adopted numbers she used in her dissertation to
22 help you figure out whatever it was you were figuring out?

23 A Yes. Conceptualizing with a ballpark figure the
24 typicality.

25 Q Do you know where she got those numbers from?

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1 A I don't remember, but it's like several institutes
2 student statisticians in Sweden.

3 Q Did you go to any of these institutes to get the
4 numbers?

5 A It was easier for me to access the thesis, since it was
6 from the same university.

7 Q Do you know how many Swedish Somalis lived in Stockholm
8 in 2008?

9 A Not exactly, no.

10 Q Well, do you know generally?

11 A Am I referring to that here from her? That was numbers
12 from 2002, so no.

13 Q No the answer is, right?

14 A Yeah. Yeah. Yes.

15 Q Do you know if Somalis in Sweden cluster in certain
16 areas? I don't know, Gothenburg, is that how you say it?

17 A Yes.

18 Q Stockholm or if a lot of them live in the country, I
19 don't know. Do you know where Swedish Somalis cluster?

20 A They are more common areas than different places than
21 others.

22 Q Mostly in the cities, right?

23 A Yes.

24 Q Do you know how many 25 to 44 years old Swedes lived in
25 Stockholm in 2008?

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1 A Nope.

2 Q And how is this information used; that is, how was it
3 useful to you in writing your report?

4 A Like I stated, it's to conceptualize. By that I mean
5 it's judgment for me, of course, on how to base all the
6 similarities and differences I find in regarding to
7 typicality, so how typical would that -- those things that I
8 find are, how typical will they be in the population.

9 So it will be very -- the only numbers kind of
10 that would make a difference would be, for example, to say
11 okay, any young male in Stockholm. That would be mean there
12 are a lot more people.

13 Q So how do those numbers help you understand typicality?

14 A It's, as I stated, you know, the ballpark figure to
15 conceptualize approximately how many are there, okay? Is
16 there a million or a thousand, for example. I could give
17 you other examples. There is a specific dialect spoken, and
18 this is from actual cases, someone is stuttering, someone
19 has a speech deficit, but they clearly speak a specific
20 dialect. And the question recording contains the same kind
21 of dialect and the same kind of stuttering, right, and the
22 same speech deficit. If that is from -- that dialect is
23 from Gothenburg, that could mean I would have to try to
24 assess typicality for maybe 250,000 young males, if it's
25 young male speaker. It's from a tiny village, as has been

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1 one case north of Gothenburg. It might mean that only a
2 thousand people there. That gives -- it's easier to make an
3 impressionistic judgment on typicality.

4 Q So now you're just talking about odds, right, one in
5 1,000 is better than one in 250,000?

6 A To some extent, yes.

7 Q But does knowing that number help you understand speech
8 traits of that population?

9 A Not unless there is a study on that specific dialect
10 for that accent.

11 Q And we've determined there is no such study, right?

12 A No.

13 Q So it didn't help you at all in understanding what you
14 really needed to understand what ways of speaking were
15 typical and what ways of speaking were atypical in the
16 Somali Swedish population?

17 A I would say, if that's what you are referring to, I
18 would still have to rely on my professional experience and
19 empirical judgment on all the Somali and Swedish speakers I
20 heard throughout my years of collecting dialect databases,
21 Swedish speakers with different accents and casework.

22 Q Now, you talked about typicality on a number of
23 occasions, right?

24 A Yes.

25 Q And if you find similarities and regularities in speech

1 from different samples, they only support or are important
2 in your comparison, if they are atypical, right?

3 A Yes.

4 Q If everyone a certain population or many, many people
5 pronounce "au" one of the things ways you discussed, that
6 wouldn't helpful for you to figure out which any of these
7 people was, is that fair to say?

8 A That's fair to say.

9 Q Now, you, I take it, have studied Somali speaking
10 Swedes?

11 A To some extent I have a lot of the experience listening
12 to it, yes.

13 Q Because you're friends with a lot of Somali speaking
14 Swedes?

15 A To some, yes. And also, of course, by what I referred
16 to earlier; collecting databases, for example, and different
17 speakers. But also listening to the many different kinds of
18 speakers.

19 Q And have you written any articles showing the things
20 that you think are common or typical and the things that you
21 think are uncommon or atypical in that population?

22 A Nope.

23 Q Have you given any papers on that subject?

24 A Nope.

25 Q So this is just you saying I know some Swedish Somalis;

1 therefore, I know about Swedish Somalis?

2 A That is a very generalization, but I see what you're
3 getting at, and I say yes.

4 Q And the Swedish Somalis you know, are they mostly from
5 Gothenburg or Stockholm?

6 A Both.

7 Q How many do you know, altogether?

8 A You mean personal? As in a personal question?

9 Q Yeah.

10 A I have to define how close, but, yeah, to some extent I
11 know maybe ten to 20.

12 Q And how many have you recorded?

13 A Recorded?

14 Q Yeah.

15 A So I was referring to our databases earlier, so there
16 is not more than ten or 20 recorded.

17 Q So all the things that you know about Swedish speaking
18 Somalis are from what you would agree might not be a
19 representative group; is that fair to say?

20 A I see what you're getting at. And you're correct, it's
21 all -- this all comes from this experience that you want and
22 nothing else, so you're correct.

23 Q Now, in the general Swedish-speaking population, all
24 Swedes, would one expect to regularly hear the use of the
25 world inshallah?

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1 A That occurs, yes. Quite often, yes.

2 Q Well, do you know what percentage of the Swedish
3 population is Muslim?

4 A No, but many.

5 Q Many, like --

6 A I wouldn't know. I honestly have --

7 Q Do you know what percentage of the Swedish Somali
8 population is Muslim?

9 A Large majority.

10 Q Would it be fair to say over 99 percent?

11 A This is not my area at all, so I wouldn't be able to
12 answer that.

13 Q I'm sorry?

14 A My guess would be that too, yes.

15 Q Would it be fair to say that the use of the term --
16 well, do you know what the term inshallah means?

17 A No, not exactly.

18 Q Have you heard it used?

19 A Oh, yes.

20 Q Would it be fair to say, do you think, that it's very
21 fairly commonly used in the Swedish Somali community?

22 A Yes.

23 Q And that it is not atypical in any way?

24 A No. Only possibly in the way it is pronounced. When
25 you look at intonation of it, the Swedish influence and the

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1 accent of one or two, and the parts of different sounds in
2 that pronunciation of that word.

3 Q But not just the use of the word inshallah?

4 A No, correct.

5 Q Now the other fillers that you say were used here, and
6 I'm not going try to pronounce them, but you can look at
7 them.

8 A There are dip thongs and fillers with repetitions.
9 There are other things mentioned, examples, yeah.

10 Q Yeah. One of -- you say there is consistent use of
11 pronunciations of fillers, and then you should pronounce
12 the first one, I can't, it begins with a "B" it's on page
13 nine at the bottom to the final paragraph.

14 A Oh, brorsan? Brother.

15 Q And is that English? I mean, in Swedish? I'm sorry.

16 A Yes.

17 Q And it's something other Swedes say?

18 A Oh, yes. Yes. That's a very --

19 (Continued on the next page.)

20

21

22

23

24

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1 BY MR. STERN:

2 Q And what do you know about that that's odd about the
3 pronunciation?

4 A Are you talking about referring to this case?

5 Q Well, yes.

6 A No. I'm just stating that it was consistently used in
7 the same way in the same kind of positions before pausing,
8 for example.

9 Q And you find that to be atypical?

10 A I'm not sure I'm -- that specific is extremely
11 atypical?

12 Q Common.

13 A I would say if it would not have been consistent, for
14 example, I would have stated it as support, supporting the
15 other probability that there are different speakers.

16 Q But it's consistent but not unusual?

17 A I see what you're getting at.

18 Q How about the next one that I'm not going to try to
19 pronounce?

20 A The way of the repetitions, how many, and instances of
21 that and how to -- and again, if it's consistent or not.

22 Q Was there anything atypical about the way that was
23 used?

24 A No. Only the way it perceptually sounded to me and my
25 colleague.

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1 Q You just thought it sounded like the same person?

2 A Yes.

3 Q And did you make any phonetic notes of what made you
4 think that?

5 A There might be some, yes, in the text grids. All the
6 text grids.

7 Q No, I know what they are.

8 A Okay.

9 Q And you also list in this section the word
10 "Insha'Allah, right?

11 A Yes. Probably because we have the perceptual, again,
12 impression that they sounded similar.

13 Q When you say the perceptual impression, is that what
14 you said?

15 A Yes.

16 Q Do you mean by that we should just take your word for
17 it that that's proof of something?

18 A I see what you're getting at and, yes, it's all based
19 on my professional experience, academics, so yes.

20 Q When you were -- let's talk now a little about the
21 biometric automatic voicemails, if we could.

22 A Yes.

23 Q Did you have tests where Batvox has been tested with a
24 speaker wearing a mask speaking into a lapel mic and that's
25 being compared to a cellphone?

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1 A Very, very few examples of that. So we could not
2 perform an evaluation, if that's what you're getting to,
3 it's true.

4 Q And you've talked about the reference population,
5 right?

6 A Yes.

7 Q And where does that reference population, in this test
8 specifically, where did it come from?

9 A You're referring to hypothesis number 1.

10 Q Well, I'm talking about now when you were setting up
11 Batvox to do whatever it is it does.

12 A For the known speaker, there is a reference population
13 so that contains several thousands of mobile phone calls and
14 also thousands of landline phone calls, because there were
15 both landline and mobile phones in those examples.

16 Q Okay. Well, let's talk about specifically about the
17 comparison of the cellphone calls to the video, okay?

18 A Yeah, yeah. That's what I was referring to.

19 Q So those aren't landline calls, those are cellphone
20 calls?

21 A There's a landline. The jail call is a landline call.

22 Q Were you able to do biometric testing on the jail
23 calls?

24 A I used that for modeling the known speaker, all the
25 four mobile phone calls that I received, plus the jail call

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1 which is a landline.

2 MR. STERN: Could we have one second, please,
3 Judge?

4 THE COURT: Yes.

5 (Brief pause.)

6 BY MR. STERN:

7 Q Now, of the calls you were comparing, did you know
8 which were digital and which were analog?

9 A No. I think it's somewhere in the report, right, that
10 we suspected because of the sound of the noise from the jail
11 call that we suspected it was analog. We have then gotten
12 information that it is a digital recording.

13 Q And when you put information into Batvox, are you
14 expected to put in whether or not it's a digital or analog
15 recording?

16 A In the metadata you can tag that, yes.

17 Q And did you do that?

18 A Probably, yes.

19 Q Now, we're talking about the reference population. You
20 said it's tens of thousands of landline and cellphones,
21 right?

22 A Yes.

23 Q And maybe I'm asking you the same question, I'm sorry
24 if I am, but how many Swedish Somalis are in that reference
25 population?

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1 A So again, referring to what we were talking about
2 before, so there's only 10 or 20 in there.

3 Q And that's what you mean by reference population we're
4 talking about now?

5 A Yes. For the voice comparison, yes.

6 Q Okay. And how did you determine that the database you
7 used was appropriate?

8 A So since Batvox presumes and there have been studies
9 that there is no influence on dialect or language, we could
10 use all the data to train the known model in this case and
11 thereby also only connecting the reference population
12 belonging to either mobile phone recordings or landline
13 phone recordings that contain the same acoustics.

14 Q So when you say there's no influence on language or
15 dialect, do you mean that if a person was speaking one of
16 the dead languages you studied, Batvox would still evaluate
17 it and the scores wouldn't change?

18 A Yes.

19 Q Why then don't they just have, for example, all Swedish
20 speakers or all native English speakers in the reference
21 population?

22 A As long as the acoustics is the same as the files that
23 you have used for training a known model. The acoustic, the
24 channel conditions, are much more important to model.

25 Q By acoustics, you mean how someone sounds, basically?

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1 A No, no, no, no. The way it's recorded and the
2 acoustical environment. That's the mismatched conditions,
3 that's what that means.

4 Q These were mismatched conditions, right?

5 A Yes.

6 Q Are you limited to the groups that are built into
7 Batvox or can you add your own groups?

8 A Are you talking about the reference population?

9 Q Yes.

10 A Yes. The reference population, I -- you add yourself.
11 It's up to the analyst to add reference populations.

12 Q And how did you select the reference populations?

13 A I selected all the recordings that met the criteria of
14 having the same acoustic environment I was explaining.

15 Q Which means what?

16 A So all landline that was available to me and all the
17 mobile phones available to me. Then -- you want me to
18 explain it further?

19 Q Yes.

20 A Okay. So what we were talking about before several
21 times as well is the selection of a subset of that reference
22 population that best suits the acoustic conditions of those.
23 So out of those 10-, 11,000, whatever it is, select 45
24 closest to the model.

25 Q 45 closest according to what? The tone of voice, the

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1 what?

2 A It could be the tone of voice but also the acoustic
3 environment.

4 Q Which means whether it's a landline or a cellphone?

5 A Yes.

6 Q But they are all landlines or cellphones, right?

7 A Yes.

8 Q So what specifically do you mean when you say the
9 acoustic environment?

10 A Yes. That's connected to all the reference -- the
11 whole reference population you're putting in there. Then
12 this subset is selected and that's just the scoring. So you
13 score the known against all those several thousands, okay.
14 This is a score as well.

15 Q But the score is based on what? That's what I'm not
16 understanding.

17 A A matched score again. The likelihood ratio score that
18 you get out of the system before it comes a likelihood
19 ratio. So you score it against all of those and you select
20 the 45 closest.

21 Q So what I'm not understanding is you score it based on
22 the kind of call, analog or digital, or you score it based
23 on a high or low voice or on an accent?

24 A When it's selected the 45, it's the 45 closest. By
25 that, I mean the closest voices, okay.

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1 Is that what you're getting at?

2 Q That is what I'm getting at. Do you mean like high or
3 low? I don't know what the traits are.

4 A Voice quality. Tamber (phonetic). The tamber, the
5 voice. How similar they are in the calculation by the
6 system.

7 Q So it has nothing to do with language or accent or word
8 usage or anything like that?

9 A Exactly.

10 Q It just has to do with how the voice sounds to the
11 machine?

12 A Yes.

13 Q And when you say it picks the 45 closest, if someone
14 had for some reason a very strange voice, the 45 closest
15 could still be far from that voice, couldn't they?

16 A Yes.

17 Q Okay.

18 A It would be a very atypical voice.

19 Q You talked a little bit about error rate which you're
20 not that happy about. I don't mean you're not happy to talk
21 about.

22 I mean, you don't agree with them, right?

23 A Yes.

24 Q And you talk about NIST doing experiments to determine
25 error rates for different systems.

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1 A Yes.

2 Q And is it accurate that those tests were done under
3 optimal conditions?

4 A There are many different conditions. So in 2012 is
5 noise added and there's also recorded noisy environment, for
6 example.

7 So is that an answer to your question? There are
8 many different conditions.

9 Q But my question is this: When they did them, whoever
10 did them, they made professional recordings of some sort,
11 right?

12 A Yeah, yes.

13 Q Or did they go out on the street and just take a
14 microphone with them and walk around and record whoever they
15 saw?

16 A Probably not. But you probably have to ask the ones
17 managing the recordings at NIST how they record it.

18 Q I'm sorry?

19 A How they record it.

20 Q Correct. So you don't know whether it was done under
21 what we might loosely like call real-life conditions or
22 laboratory conditions?

23 A I know there are phone calls that I listened to, parts
24 of some NIST material. Many of them are phone calls.

25 Q Do you know the source of those calls?

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1 A What do you mean by the source?

2 Q Well, were they done for the testing or are they random
3 calls?

4 A It sounds like normal conversations to me, but probably
5 they are aware that they are being recorded, I assume.

6 Q So they are not like the calls that were intercepted
7 here where presumably the people had no idea they were being
8 recorded?

9 A You mean, like situational factors?

10 Q Right.

11 A Oh, yes. I follow you, yes.

12 Q And you also talk in your report about something called
13 the "Human Assisted Speaker Recognition" done by NIST,
14 right?

15 A Yes. 2010.

16 Q 2010. Did you participate in this testing?

17 A No.

18 Q Do you know people who did?

19 A Yes.

20 Q And the people who did were people with some experience
21 in speech identification, right?

22 A Yes. Well, most of them used panels of naive
23 listeners. By naive, I mean not trained in linguistics and
24 phonetics. I have also done similar experiments for my
25 data.

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1 Q In that case -- well, withdrawn.

2 Have you ever been tested to see what your
3 accuracy rate is when you didn't know the answer in advance?

4 A So the NFC can provide blind tests for us whenever they
5 want. And they don't have to tell us. I presume that it's
6 not very often because it costs them money basically. But
7 that's the only way.

8 And then what we do within the lab is in some
9 cases that we feel are particularly difficult, we have to
10 ask the NFC if we could make a blind test for a third
11 person, which is actually a Ph.D. student at the university
12 who has done her masters in forensic speech language as
13 well. So sometimes we do blind testing as well.

14 Q But have you ever been tested, that you know of, by the
15 NFC and given the results in a blind test?

16 A No.

17 Q And so you rendered results in these 350 or 400 cases
18 and in those cases like here you say we should rely on your
19 expertise, right?

20 A Yes.

21 Q Now, in this HASR test, which for short I'm going to
22 say that, you're aware that there was a wildly varying error
23 rate, aren't you?

24 A Absolutely.

25 Q That for some pairs, by which we means two calls,

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1 right?

2 A Yes.

3 Q Some everyone got right, there was a zero percent error
4 rate, right?

5 A Yes.

6 Q And some there was as much as a 60 percent error rate.

7 A Yes.

8 Q And within examiners -- and I'm calling you examiners.
9 I know you say that some of them are what I'm going to
10 loosely call lay people.

11 A Yes, exactly.

12 Q There were some people who had a lowest which was a 6
13 percent error rate, right?

14 A It's very possible, yes. I can't remember the exact
15 numbers, of course, but I take your word for it.

16 Q And does it sound right that some were as high as a 50
17 percent error rate?

18 A For some voices, yes.

19 Q Now, when you're doing your evaluations, do you assign
20 a specific percentage weight to the automatic system, the
21 biometric system, I'll call it?

22 A No.

23 Q That, again, is something experiential, right?

24 A Yes.

25 Q We should take your word for how much weight the

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1 biometric system gets?

2 A Yes.

3 Q And just let me look at something for one second. I'm
4 sorry.

5 A No problem.

6 MR. STERN: I'm sorry, Judge. I'm just going to
7 find it in one minute.

8 THE COURT: All right.

9 (Brief pause.)

10 BY MR. STERN:

11 Q Let me read you something from your report. It's under
12 the section that's entitled "Additional." I think it's on
13 page 8 if I'm right. And I'd like you to tell me what it
14 means.

15 It says, "For a mismatched test, an analyst is
16 better at judging the value of a score or a likelihood ratio
17 than the machine itself and the analyst will, together with
18 the other results of the analysis, judge where in a
19 likelihood ratio span the outcome should be placed, i.e., on
20 which level in the ordinal scale."

21 A Yes.

22 Q What does that mean?

23 A It means depending on how well I think you can perform
24 the test with the automatic voice comparison software, how
25 well that test is. So depending on the quality of the

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1 audio, all the feedback you get from the system regarding
2 the quality and the duration of the recordings and
3 everything else, depending on how well the test is.

4 Q Did you have appropriate duration in this case?

5 A Yes. For most of it, yes.

6 Q And for many of the calls did you have appropriate
7 quality?

8 A For many of them, yes.

9 Q But you disagreed with the outcome that Batvox arrived
10 at, didn't you?

11 A You're referring to hypothesis one now, yes?

12 Q Yes.

13 A Mismatched. Yes, yes.

14 Q And you agreed because of your own personal experience?

15 A Yes. On how it evaluates for these kind of mismatched
16 conditions in combination with a phonetic analysis.

17 Q And so again, this is a place where we should just take
18 your word for it that your score is more representative of
19 what really happened than the score of Batvox?

20 A Yes.

21 May I make a comment?

22 Q No, not unless the Judge says you can. I'd rather you
23 just answer my questions.

24 A Okay.

25 Q Now, I want to go ahead now to the section that's

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1 called "Results," which is on page 9, I believe.

2 Do you see that section?

3 A Yes.

4 Q You say you had information from an earlier case. And
5 by that were you referring to the work you did for the
6 Swedish police?

7 A Yes.

8 Q And you talk about analysis of laughter and you showed
9 us what I think was a spectrogram of laughter.

10 Do you recall that?

11 A Ms. Salick did, yes.

12 Q But that laughter doesn't in any way help you with the
13 videotape, does it?

14 A No.

15 Q And there's no laughter at all on that videotape, is
16 there?

17 A No, no.

18 Q Now, I think you said earlier that you didn't calculate
19 any likelihood ratios, right?

20 A For the phonetic and linguistic analysis, you mean?

21 Q Well, other than Batvox.

22 A Other than Batvox, yes.

23 Q There were no likelihood ratios?

24 A No. Just likelihood ratio scores for the long-term
25 formant analysis.

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1 Q And you would agree, I take it, with this statement
2 that holistic likelihood ratio span is judged
3 impressionistically; is that right?

4 A Yes.

5 Q Those are your words.

6 A Yes.

7 Q And what does that mean?

8 A It means, as explained earlier as well, that you
9 compare the consistencies with all the similarities and
10 differences that you find in the different recordings, and
11 you try to assess the typicality somehow. And then you
12 judge the likelihood ratio span of that, which is one level
13 on the scale.

14 Q And you're saying that the likelihood ratio span is a
15 plus three?

16 A In that case, yes.

17 Q That's a likelihood ratio span?

18 A Yes.

19 Q Because a likelihood ratio is a specific thing, isn't
20 it?

21 A It can be calculated, but with basic reasoning you
22 could also, of course, appreciate something or what's the
23 right word? Judge that.

24 Q It can be calculated, but it was not calculated?

25 A That wasn't calculated.

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1 Q Although you refer to the likelihood ratio span.

2 A So the automatic system will calculate this likelihood
3 ratio and that likelihood ratio will be boosted by what you
4 have come up with in all the other analyses or it will be
5 decreased depending on the other parts of the analysis,
6 right.

7 Q Boosted or increased or decreased in the sense that we
8 should take your word for it?

9 A Yes.

10 Q Now, we talk about how when you first did testing back
11 in 2011, I'm talking about for the Swedish police now, you
12 came up with an ordinal on the Nordgaard scale of 2.

13 Do you recall that?

14 A Yes.

15 Q And we're talking about the NFC scale.

16 A I know what you mean, yes.

17 Q What additional information did you have about
18 comparing the videotape to the Swedish phone calls that made
19 you come out with a plus three when you did the test for the
20 U.S. in 2014?

21 A I was able to carry out much better automatic voice
22 comparison using an additional landline phone call and a
23 much better software system.

24 Q So you mean Batvox made the difference to you?

25 A Yes.

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1 Q Well, isn't it true that just like the first time, the
2 score of the biometric testing you got was a two?

3 A You mean, the likelihood ratio span that that ended up
4 within, that is correct, yes.

5 Q If you take the number that Batvox gave you and you
6 convert it to the kind of numbers, it was a two just like
7 the first time?

8 A Yes.

9 Q So that couldn't have changed your opinion, could it?

10 A Well, like we've made clear just a few minutes ago, we
11 were talking about how the analyst is much better at judging
12 because it will know -- an analyst that has evaluated and
13 worked a lot with automatic machine will know much better
14 where this span of likelihood ratios will end up.

15 So, yes, if you were totally connected to what is
16 being calculated, then, yes, you would end up in the plus
17 two again. But if you add your judgment to that, again,
18 taking my word for it, because of all the testing and all
19 the experience I have with the software, I know which span
20 we're going to end up in when it's mismatched conditions and
21 we do that testing.

22 Q But you don't make judgments about the score Batvox
23 comes up with, do you?

24 A Yes.

25 Q Don't you feed in the information and Batvox in the end

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1 kicks out a number?

2 A Yes.

3 Q And don't you have protocols that tell you how that
4 number is supposed to be converted?

5 A Not from that number to the ordinal scale because then
6 I wouldn't add all the other information and also that
7 number is within a span. So for a mismatched test you will
8 know that it will not generate --

9 Q Just I want to make sure I understand. Are you saying
10 that the Nordgaard scale, which you used to convert the
11 information from Batvox to an ordinal number, doesn't tell
12 you a specific range?

13 A No, it does. It does.

14 Q And your protocols require you to follow that, don't
15 they?

16 A Yes. But you have to add all the information I have.
17 And I am not using the likelihood ratio score from Batvox as
18 a number in itself, as we have clarified many times. I
19 would use it also as judged score made by the system, but I
20 also have seen many, many likelihood ratio scores for
21 different kinds of testing.

22 I know that 158 for a mismatched test like that is
23 much higher, for example, than a test between mobile phone
24 calls only. So that gives you an example. The score space
25 is completely different. So I'm, again, using that score, I

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1 am assessing how good or bad that score is. You are
2 correct. If I use only that specific number and put that
3 within the likelihood ratio span from the Nordgaard scale,
4 it is a plus two, you are correct.

5 Q So now in addition to relying on your word from your
6 own analysis, we should rely on your word for the number the
7 machine spits out even when your word is different than the
8 one generated by the machine; is that right?

9 A Yes.

10 Q Now, I want to show you a document that's from your
11 2011 report.

12 MR. STERN: May I approach, Judge?

13 THE COURT: Yes.

14 MR. STERN: It says "LLR score Versus Model."

15 BY MR. STERN:

16 Q Do you recognize that document?

17 A Yes.

18 Q What is it?

19 A It's a figure of all the tests run in that specific
20 case. So you get a test score and then compare that to like
21 this reference population used, instead of in that case when
22 I was using Alize, I would just score against probably 500,
23 I think it was, that I selected with the same acoustics
24 again. And then just plot all those scores and see the
25 dispersion of the scores.

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1 Q And read the word at the top of the graph.

2 A Likelihood ratio score versus model.

3 Q And what information does that graph give you?

4 A It gives me the information on the dispersion of the
5 scores that I received for each test.

6 Q Does it tell you anything about the meaning of those
7 scores?

8 A It gives me a rough idea, yes, on how the scores are
9 dispersed for the actual test and the test against other
10 recordings containing the same kind acoustics.

11 Q What's the rough idea it gives you?

12 A So if it's a long distance between -- so first of all,
13 the test that you're interested in, so unknown and known,
14 that should of course end up on the top if it's going to
15 tell you anything or give support. That test score gives
16 you support that the voices come from the same speaker, same
17 voice, if that's the highest rank, of course, it's at the
18 highest score.

19 And then it's the long distance to the next scores
20 that gives me an idea of how strong that score is, okay.

21 Q And so what does that tell you about how strong those
22 scores were?

23 A I probably described that in the report actually.

24 Q Oh, you have it right in front of you.

25 A Not the 2011.

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1 Q Oh, you mean, you need the whole report? Okay.

2 A Wait a minute. I can read maybe below. No, no.

3 THE COURT: JL-1 is Swedish?

4 MR. ARIAIL: Yes, your Honor.

5 THE WITNESS: So it doesn't seem I have commented
6 on that specific. I only did the attempt to quantify that
7 into a likelihood ratio.

8 BY MR. STERN:

9 Q So looking at it now, do you have any idea what that
10 means?

11 A Oh, yeah. The dispersion of scores. I mean, it's
12 quite a meaningless graph if you ask me now, but I thought I
13 should have something back then.

14 Q Well, it doesn't mean there is support or isn't support
15 for either hypothesis?

16 A Yes, it does.

17 Q What does it mean?

18 A So it means that it gives support to some extent for
19 the --

20 Q I'm sorry. And you didn't comment on it at all in that
21 report?

22 A I think I tried to by using the -- well, the summed-up
23 thing in the -- under hypothesis.

24 Q And did you use it at all in the report from 2014?

25 A No, no.

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1 Q But was that part of your impressionist understanding
2 of the strength of these hypotheses?

3 A For when I did the examination now?

4 Q Yeah.

5 A The later one? No.

6 Q You forgot about it then?

7 A Didn't forget about it, but it didn't influence us very
8 much. I redid the test.

9 Q Are you familiar with something called cognitive bias?

10 A Oh, yes.

11 Q What is cognitive bias?

12 A So, yeah, based on all the information you get that
13 will sometimes affect the way you interpret different
14 things.

15 Q And cognitive bias is not somebody doing anything bad,
16 it's doing something human, right?

17 A Absolutely.

18 Q And did you do anything to avoid the influence of
19 cognitive bias?

20 A The stuff we were talking about before with the blind
21 testing and so on. But that's pretty much -- and then, of
22 course, we try to actively -- we were talking about so at
23 the NFC I think I mentioned at some point that they have
24 these calibration meetings or disciplines and so on. That's
25 how you try to -- the fingerprinting or we have a man doing

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1 signature analysis, handwriting, all kinds of different
2 disciplines. And we try to talk about using the ordinal
3 scale, what kind of conclusions you would come up with for
4 certain typical or atypical differences and similarities.

5 Q And that avoids cognitive bias how?

6 A It gives you an idea of how you try to assess where in
7 the scale you are for certain features, to some extent. But
8 nobody is free from cognitive bias, I see what you're coming
9 to, absolutely.

10 Q And when you do work on this case with your colleague,
11 you work on it together and discuss it with each other,
12 right?

13 A Yeah. Well, my colleague will prepare everything for
14 me, and then I will start performing the different --
15 similarities and differences and so on and the phonetic and
16 linguistic analysis.

17 Q Well, what I'm getting at is you don't do a report and
18 not tell them anything about it, then give him or another
19 examiner the same information and not tell that person
20 anything about it and then compare your reports to see if
21 you come to the same conclusions?

22 A Me and my colleague do that, to some extent, the
23 comparison and so on. He will prepare so he will know more
24 and then give that to me. And then of course afterwards we
25 will sit down and discuss that, kind of consensus thing as

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1 speech pathologists will do all the time when they assess,
2 for example, voice quality problems with different patients
3 and so on.

4 Then I told you as well that we for some cases
5 would have this Ph.D. candidate that will come in and that
6 will be blind testing.

7 Q Well, did you do that in this case?

8 A No.

9 Q And when you and your colleague do this, you discuss
10 the case you're talking about, right?

11 A Yes.

12 Q You discuss the suspicions you had?

13 A Discuss the different similarities and differences that
14 we have found.

15 Q So that's in no way a blind test, is it?

16 A No. It's not a blind test in that sense, no.

17 Q Okay. Now, you're familiar, aren't you, of differences
18 in the scientific community about the way things should be
19 done in forensic speech recognition?

20 A Are you referring to Dr. Morrison's?

21 Q Not just Dr. Morrison. Generally.

22 A There are different opinions, yes, and ongoing
23 discussions all the time, yes.

24 Q For example, in the U.S., do we use the ordinal scale?

25 A I think there -- what I know is I've seen people talk a

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1 lot more about this match, no match thing.

2 Q And that's a very different system, right?

3 A Yes.

4 Q And there's not agreement on which is the better
5 system. Each place, the U.S. and Europe, have their own
6 feeling about it?

7 A Well, that's a long discussion, but I would -- to me
8 it's extremely important to have something I would call a
9 logical coherent framework. And that is expressing
10 probabilities. And in the same way that we are talking
11 here.

12 Q In the U.S., for example, the FBI doesn't agree with
13 your way of doing it, do they?

14 A You have to ask Dr. Nakasone in about this and you will
15 get a chance.

16 Q I'm asking if you know it.

17 A I think they have some match, no match. So we have
18 differences there, absolutely.

19 Is that an answer to your question?

20 Q Yes.

21 A Sorry.

22 Q And aren't there differences about whether the
23 reference population should be connected to the suspect or
24 the known speaker?

25 A No, I don't think so. Are you talking about automatic

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1 voice comparison?

2 Q I misspoke myself. I meant the suspect -- that's why
3 you were confused. The suspect and the known
4 speaker -- unknown. Suspect and the unknown speaker, sorry.

5 A Rephrase.

6 Q Yes. Some people think that the reference population
7 should be derived from the suspect, right?

8 A Uh-huh. Yes.

9 Q And there are other people who think that it should be
10 derived from the unknown speaker?

11 A Are we talking about automatic systems now?

12 Q Yes.

13 A In that case we have both. We have a reference
14 population connected to the known speaker. You will score
15 to get an idea from the unknown against all the reference
16 population. But you also score within the known model to
17 get the intra-variation and those scores are more normalized
18 using this impostor set. And the impostor set is a kind of
19 reference population regarding the unknown sample.

20 Q Are there differences among people in your community on
21 whether or not the sound should be processed in a way that
22 is always a match, that is, if you have something
23 from -- this may not be right, you'll correct me if I'm
24 wrong -- but something from a landline and you're comparing
25 it to a lapel microphone, you would try and run that through

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1 a system to make it like the sound from a lapel microphone.

2 Are there people who believe that in your
3 community?

4 A I don't know actually about any people like that
5 within -- people performing casework, you're talking about,
6 in the scientific community?

7 Q Yes.

8 A No. Maybe Dr. Morrison would do that. I'm not sure.
9 You mean, acoustically try to simulate?

10 Q Yes.

11 A Yes. Probably Dr. Morrison would do something like
12 that. That's altering the acoustics of the -- I would not
13 do that, no.

14 Q You would not do that?

15 A No.

16 Q There are people who would?

17 A Yes.

18 MR. STERN: Judge, can I have a moment, please?

19 THE COURT: Yes.

20 (Brief pause.)

21 BY MR. STERN:

22 Q I want to go back if we could to the graph that we were
23 talking about in your first report. Do you know what I'm
24 talking about?

25 A Yes.

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1 Q All those numbers are below zero; is that right?

2 A Yes. Yes, I think so. Yeah, they were.

3 Q Well, take a look.

4 A Un-normalized scores. They are normally end up below
5 zero. And I think maybe not all of them are below zero but
6 most of them. That's why we're talking about this version
7 of scores because scores in themselves un-normalized can end
8 up all over the place. Dr. Wayman I'm sure can explain all
9 of that, too.

10 Q So is it wrong to say that scores below zero support
11 the alternative hypothesis?

12 A It depends on what kind of score it is.

13 Q Low scores.

14 A No, no. It's the dispersion of scores in this case.
15 So you have to rank them. You have to rank like a list of
16 scores, okay, does it end up on the top is the first
17 question?

18 Q Is it what?

19 A Does it end up in the first rank if you rank all the
20 scores. And second, what is the distance to the other
21 scores?

22 Q Okay. Now, turn that same sheet sideways if you would.
23 This is not a trick. There's dates written on it. I just
24 want to see if you can read me the dates written on the side
25 of that document.

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1 A You mean, here (indicating)?

2 Q There should be a slightly bigger and a slightly
3 smaller date.

4 A It says September 18th, 2012, time 8:56.

5 Q Do you know what that date represents?

6 A No idea.

7 Q And what's the other date?

8 A Is there another date?

9 Q I thought there were two dates. Am I mistaken?

10 A Not that I can identify. It could be something
11 connected to when it was printed by the security service. I
12 don't know the procedures. I have no idea.

13 Q Do you recall if that was the date when you were asked
14 for the materials by the U.S. government -- by the Swedish
15 government, I'm sorry?

16 A No, I do not recall that. Is it documented somewhere
17 maybe when I gave them the material maybe or --

18 Q I don't actually know the answer to that. When you
19 were asked, I think you said sometime in the past several
20 years; is that right?

21 A It's probably 2012. It's very possible.

22 Q Probably 2012?

23 A Yes, yeah. Sorry for taking up so much of your time.

24 THE COURT: Don't worry about it. It's my job.

25 BY MR. STERN:

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1 Q We're going to get you out of here.

2 A Thank you.

3 Q It's not a favor. It just happens that way. I'm going
4 to ask you a final question, sir.

5 Has the degree of validity and reliability of the
6 implementation of analytical approaches applied in Section
7 3.2 of the most recent report been empirically tested under
8 conditions reflecting those of the conditions of the present
9 case?

10 A When you refer to validity or reliability, I presume
11 and from my experience I can probably judge that that
12 question was written by Dr. Morrison. I would say according
13 to his way of defining reliability and validity, no.

14 Q Okay. Thank you.

15 MS. KELLMAN: Your Honor, I wrote the Court
16 another letter this morning.

17 THE COURT: Do you have questions of this witness?

18 MS. KELLMAN: Well, my letter was saying that I
19 was asking --

20 THE COURT: Do you have questions of the witness?

21 MS. KELLMAN: I am not prepared to cross-examine
22 the witness, your Honor.

23 THE COURT: All right. Does the government have
24 any?

25 MR. SALICK: Very briefly, your Honor.

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1 THE COURT: Redirect.

2 MS. SALICK: Mr. Stern, do you want your computer?

3 MR. STERN: Oh, thank you.

4 REDIRECT EXAMINATION

5 BY MS. SALICK:

6 Q Mr. Lindh, just very briefly. You were asked a number
7 of questions about the difference between the conclusions
8 that you achieved in your report in 2011 versus the
9 conclusions you obtained in 2014.

10 A Yes.

11 Q Did you have a different software program in 2011 than
12 the one you used in 2014?

13 A Yes.

14 Q And what was the software program you ran?

15 A In 2011, it was my own version of the ALIZE software.

16 Q Did you at some point purchase Batvox because you found
17 ALIZE to be insufficient?

18 A We used both for one year and at the same time
19 evaluating using the most common kinds of material that we
20 receive in Sweden. And based upon that, we decided only to
21 use Batvox to produce much better results.

22 Q In 2014, you were using a software program that you
23 believe is better?

24 A Yes.

25 Q Okay. Were you also provided with more known samples

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1 of the person identified as "MY" for 2014?

2 A Yes. One jail call.

3 Q And as you said, this was a jail call. And was that
4 different from the recording mechanisms of the -- was that a
5 different recording system than what you had received
6 previously from SAPO?

7 A Yes.

8 Q Why is it important to have known samples under
9 different recording conditions?

10 A In the modeling process of this statistical modeling, I
11 mentioned I-vectors. I-vectors will try to extrapolate what
12 are features that do not belong to the voice that it is
13 trying to model and then subtract those things that belong
14 to the channel or other things that are not specifically the
15 features of the voice it's trying to model. And if you have
16 several sessions, what that means is several different
17 recordings, it's good. If you have several different
18 recordings recorded with different systems, it's even better
19 to model.

20 Q So the statistical model that's created from the known
21 sample which we discussed at length with all the hills and
22 valleys, there is no detail in that statistical model if you
23 have recordings recorded under different conditions?

24 A Yes.

25 Q In your assessment, was the test you ran in

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1 2011 -- excuse me.

2 Was the test you ran in 2014 better due to the
3 fact that you had both a better system and better samples
4 than the one you ran in 2011?

5 A Yes.

6 Q Okay. You were also asked by Mr. Stern if you were
7 under any deadlines or any imposition by the government.
8 Were you able to fully run a forensic examination in the
9 time for the December 2014 report?

10 A The draft one you're talking about?

11 Q That's what I'm talking about, correct.

12 A Except that we weren't finished with the impostor set
13 or the Batvox test regarding hypothesis one. So that was
14 one additional, completely separate, not any discussion
15 about the case, of course, but discussions and rereading of
16 the thesis and papers and discussions regarding face masking
17 with your people.

18 Q And that's -- the impostor set, you did have that
19 available for the April 2014 examination?

20 A Yes. We had it so '89 or '85 or something like that,
21 lapel microphone recordings.

22 Q Is there --

23 A To be clear, I'm not sure they are going to ask more
24 questions, but to make clear, it did not contain recordings
25 with people with face masking that impostor set, only lapel

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1 microphone recordings.

2 Q According to the protocols you've discussed at great
3 length and the 350 to 400 forensic cases that you've done,
4 was there anything that you did not do in this case? Did
5 you have time to do everything you normally do in this case?

6 A Yes.

7 Q You were asked some questions about what you described
8 as facial wear in your report referring to the mask across
9 the defendant's face in the video. Would you have been able
10 to tell if the covering had interfered with the acoustics or
11 the voice by listening to the audio?

12 A That's what came up in the discussions with Dr. Watt
13 (phonetic) and Dr. Fasha (phonetic) is how much. They were
14 describing it as if the garment is thick enough for you to
15 be able to perceive different audio quality of the speaker.
16 And it is influencing in some sense.

17 What they did find significant difference is what
18 we were talking, I think they call it -- yeah, they call it
19 POA, so place of articulation. If it's very tight and very
20 thick, it will affect on how you move your articulators, so
21 the lips mostly, of course.

22 Q And just to be clear, Mr. Stern asked you about
23 watching the video. Your analysis was based on listening to
24 the audio sample, not watching the video, right?

25 A Well, I could detect that it was a very thin garment

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1 from the recording also, of course.

2 Q But the phonetic analysis, the acoustic analysis, the
3 automated voice comparison was run on the audio sample?

4 A Yes.

5 Q What was your conclusion as to the effect based on
6 those three analyses of the facial wear on the voice on your
7 ability to judge the voice?

8 A Please repeat the question.

9 Q What was your conclusion as to the effect that the
10 facial wear had on your ability to assess the materials
11 provided?

12 A So after that, we concluded that an impostor set using
13 lapel microphone recordings would be sufficient for us to be
14 able to run the test.

15 Q So in other words, it did not affect your analysis?

16 A No.

17 Q You were also asked about cognitive bias. And I
18 believe you said it's inescapable; everyone has cognitive
19 bias.

20 A Yes.

21 Q And you briefly mentioned some methods that are used to
22 counter cognitive bias. Why does actively looking
23 throughout your analytical process for the support for the
24 alternative hypothesis assist in countering any cognitive
25 bias?

1 A It is a way to when we discuss it that it's equally
2 important to find -- so the clients are not interested in
3 one or the other thing. They want some kind of information
4 because they are actually paying for this. So it means that
5 we have to come up with these two different probabilities,
6 because there are always two probabilities.

7 And I stated and as Mr. Stern also said, you know,
8 we could never assess that the true probability of this
9 being the same voice, that is up to the trier of fact. So I
10 have never been in a case where forensic speaker comparison
11 has been used on its own. It's always collaborative
12 evidence weighing these two different probabilities. And it
13 is the trier of fact that has to use this weighing process
14 so if it's weighing one direction. But there are other
15 things presented that will also assess to some extent the
16 reliability of the examination that I conduct.

17 Is that to some extent explains?

18 Q So the client usually has a hypothesis, right? Their
19 hypothesis is that the speakers are the same, right?

20 A Normally, yes. In some cases there are -- there's a
21 suspicion that they are different, absolutely, that happens.

22 Q In this case, the hypothesis was that the speakers were
23 the same?

24 A Yes.

25 Q And it was you that came up and helped the government

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1 and SAPO come up with the alternative hypothesis that they
2 would not be the same?

3 A Yes. That's what happens in most cases.

4 Q And throughout your analysis, you were constantly
5 looking for evidence that would support the fact that these
6 speakers were not the same?

7 A Yes.

8 Q And is that a method for controlling cognitive bias?

9 A To some extent, yes.

10 Q Do you know the defendants names in this case?

11 A I've seen one of the names now afterwards, yes. Or
12 maybe in some transcripts I would have to say.

13 Q Do you know what they're charged with?

14 A No. Some kind of terrorism. I don't know the legal
15 words at all.

16 Q Before coming to New York, did you know there were
17 three defendants?

18 A No. I did not know that.

19 Q Do you know any other witnesses in this case?

20 A No. Well, I probably have spoken to one that I -- who
21 was from the security service in Sweden who was talking
22 about that they were traveling here. So maybe he is going
23 to testify. I don't know that, but I'm guessing that.

24 Q And is it standard practice when you receive material
25 from a client in your case almost always the NFC, for the

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1 client to identify in some way the unknown sample?

2 A Yes. To diminish the amount of work, of course, and
3 also for us -- for example, I mentioned the extreme example
4 of us being forced to compare female and a male voice, for
5 example, and then to make two hypotheses over that and
6 explain all these comparisons. It has happened. But then
7 they will run up with a huge bill and, oh, go back again.

8 So in many cases they will actually reduce the
9 amount of data, for example, oh, that's not interesting and
10 so on, reduce the amount to make it -- the deadline quicker
11 and the work more efficient.

12 Q So those 350 to 400 cases that you've received, you've
13 also received some information to identify which unknown
14 speaker you're testing?

15 A The suspicions they have, yes. And in many cases -- in
16 quite many cases, probably 20 percent, there are other
17 speakers maybe in the same signal and we would have to
18 clarify everything again because they haven't discovered
19 this in some -- when the police officer has listened to
20 things and so on. There are often misunderstandings.

21 Q Thank you. I want to touch very quickly now on why
22 Batvox is a language independent system.

23 A Okay.

24 Q You received a number of questions on
25 cross-examination. Are there any studies that you're aware

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1 of that have looked at whether there's any effect of
2 language on automated voice comparison?

3 A I remember there are several, but I don't remember the
4 exact reference. But I know that Herman Kunzel, the
5 professor who used to be the head of BKA, and also people
6 connected to Agnitio have done several studies using
7 different kinds of material.

8 Q And what is the general consensus of these studies as
9 to whether or not language affects the ability of Batvox and
10 automated voice comparison in general to run a study?

11 A That is language independent.

12 Q Okay. And can you explain why voice features are not
13 associated with language and why it is that Batvox is
14 language independent.

15 A It's also the not finalized thesis I have written.
16 It's very much regarding trying to separate what is behavior
17 that you have acquired at a young age, we're talking about
18 how you speak, so the behavioristical features of how you
19 speak. And the other more connected to biometrics is the
20 actual features of your voice. That could be the voice from
21 someone actually just saying "ah" with no information in it
22 and the statistical model of that.

23 So to some extent we're talking about the
24 reflection of the vocal tract in the speech signal or in the
25 recorded audio, yes, and the divide between those two. So

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1 in the automatic sense, you are not interested in or to very
2 little extent because there's something called delta
3 features. It has some temporal features in it. But besides
4 that, there's nothing connected to what actually happens in
5 time. It's all in the statistic model matched together.

6 So if you look at verification again, which is the
7 way you have to make a decision, okay, yes or no or match,
8 no match, in that case, there are systems. They are usually
9 called text dependent system. And the one we are talking
10 about is text independent system. So text dependent system
11 would be dependent on what is being said as well. And that
12 contains yet another module which is connected to speech
13 recognition. So what is being said on a different segments
14 are evaluated. But that's a very long story. I've taken up
15 very much time in this court.

16 Q So because Batvox is language independent, it doesn't
17 matter what the language is of the samples making up the
18 reference population or the impostor set; is that correct?

19 A Yes.

20 Q And because Batvox is language independent, is this
21 another reason why you perform a phonetic and linguistic
22 analysis on the material you receive to fully understand the
23 hypothesis that you are given?

24 A Yes.

25 Q You were asked a number of questions --

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1 THE COURT: We're going to take five minutes, five
2 minutes, and then we'll go on.

3 (Continued on the next page.)
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J. LINDH - REDIRECT - MS. SALICK

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1 THE COURT: All right. The defendants are
2 present, and counsel. Mr. Lindh is still on the stand,
3 still under oath.

4 COURTROOM DEPUTY: Judge, we're missing the
5 Swedish interpreters.

6 THE COURT: Oh, the most important people.
7 (Pause.)

8 THE COURT: Swedish interpreters are also present.

9 REDIRECT EXAMINATION (Continued)

10 BY MS. SALICK:

11 Q Mr. Lindh, on cross-examination, you were asked about
12 your experience with the Swedish -- Somali Swedish
13 community, and Mr. Stern asked you about your friends.

14 Do you have other experience from your forensic
15 work analyzing Somali Swedish speakers?

16 A Yes.

17 Q Can you briefly explain what that is?

18 A Other recordings containing that kind of speech.

19 Q So in the analyses you provided for the National
20 Forensic Center, you have examined recordings in which
21 Somali -- in which people speak both Somali and Swedish?

22 A Yes.

23 Q And based on that, were you able to draw out things
24 that were typical or atypical to those speakers?

25 A Yes.

J. LINDH - REDIRECT - MS. SALICK

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1 Q Turning quickly to error rates and we went over some of
2 this, but is there generally some -- are there calculated
3 error rates for automatic voice comparisons?

4 A Many, many different.

5 Q Are there many for Batvox?

6 A Yes.

7 Q And is each error rate condition dependent?

8 A Yes.

9 Q Meaning that it depends on a variety of conditions that
10 the examination is looking at?

11 A Yes.

12 Q Okay. In forensic examination would it be possible to
13 have a true error rate for every single forensic examination
14 that you run?

15 A If you -- probably. And I don't know if we're going to
16 hear Dr. Morrison talk, but he would like probably for us to
17 take the same microphone down to Somali and record a
18 thousand Somalian Swedish speakers at that same place, and
19 then have phone calls recorded from a thousand people;
20 evaluate all the comparisons between similar and different
21 speakers, and then come down with a -- you know, it's cost
22 that we use for lack of --

23 Q So in that 350 to 400 forensic examinations that you
24 performed, those all contained different conditions, right?

25 A One can say that every case is unique.

J. LINDH - REDIRECT - MS. SALICK

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1 Q So to calculate an error rate that would be true for
2 each test, you would have to run thousands of tests under
3 that one -- under those conditions?

4 A Yes. So every case is different. You would have a
5 research project for every case, and you would have to right
6 write a book for the report of every case.

7 Q Have you ever been provided with an error rate for the
8 -- to match specifically each test that you performed?

9 A That's a difficult to --

10 Q I'll withdraw it.

11 You were asked a number of questions about your
12 findings with respect to hypothesis number one; comparison
13 of the video and the two audio calls.

14 Did your phonetic findings show support for
15 hypothesis one?

16 A Yes.

17 Q For the prosecution hypothesis, the speakers were the
18 same?

19 A Yes.

20 Q And did Batvox also determine that there was support
21 for the fact that the speakers were the same?

22 A Yes.

23 Q The last question Mr. Stern asked you respecting
24 validity and reliability, I believe you gave an answer that
25 Dr. Morrison would give. Do you remember that question?

J. LINDH - REDIRECT - MS. SALICK

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1 A Yes.

2 Q Is your answer -- answering as yourself different?

3 A When it comes to research, we have many things in
4 common, and that's why we have worked together. But
5 Dr. Morrison does not have casework experience. And part of
6 that is because it is not possible with his way of dealing
7 with this problem to perform casework. As I stated, you
8 would have to collect the database, you would have to run
9 evaluations similar to the condition of the case, language,
10 everything followed. You would have a five-year research
11 project and a book published for each case.

12 Is that an answer to the question?

13 Q Would it be impossible to do casework under
14 Dr. Morrison's methodology?

15 A Yes, more or less.

16 Q You were asked a number of times if we should take your
17 word for it. Do you remember those questions?

18 A Yes.

19 Q Which I believe infers whether there is subjective
20 judgment in forensic science.

21 Are you generally familiar with other forensic
22 science disciplines?

23 A To a little extent.

24 Q Is there subjective judgment in DNA analysis?

25 A To some extent.

J. LINDH - REDIRECT - MS. SALICK

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1 MS. KELLMAN: Objection. Is he an expert in DNA,
2 Judge?

3 THE COURT: Well, he can answer the question if he
4 can answer it.

5 THE WITNESS: To the extent that in DNA matching
6 we would have to calculate random match probability, right?
7 And you would have to have a data set to calculate that
8 random match probability; and that is based on some database
9 and who selects that database. That's, to some extent,
10 subjective, okay?

11 And the same thing goes for fingerprinting. You
12 have someone visually comparing and somehow assessing how
13 typical certain fingerprints are visually, okay?

14 Q And you also willingly admitted that there was
15 subjective judgment in how you weigh the scores between the
16 three methods that you use in your forensic examination?

17 A Yeah, depending on the judge to be called here there is
18 similarities and differences, yes. I don't know if you can
19 call it objective judgments or what is that, then you have
20 to define that.

21 And then does a doctor do objective judgments
22 looking at tests. And you know there are some false
23 acceptance and false rejections from many medical tests.
24 And a doctor will talk to the patient and then he will
25 assess different other health factors, and then decide on

J. LINDH - REDIRECT - MS. SALICK

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1 whether it's likely that he has the disease or not, right?

2 That's an objective judgment. The Court has to do
3 decisions all the time, trier of fact, yeah.

4 Q Mr. Lindh, what is your subjective judgment based on?

5 A What we have been talking about, all the similarities
6 and differences found throughout the whole examination.

7 Q Is it also based on your ten years plus of working in
8 forensic examination?

9 A Based on all my experience, I would say everything.
10 But absolutely, of course, most relevant is the experience,
11 the professional experience on how. And also maybe 20 years
12 or so linguistic and phonetic analyses, collecting
13 databases, listening closely to different speakers and
14 different features and being aware of channel differences
15 listening to it and performance of different automatic
16 systems under definition.

17 Q And are these subjective judgments been the ones you've
18 testified to in court before?

19 A Yes.

20 Q And are these subjective judgments the ones that have
21 been accepted by the National Forensic Center?

22 A Yes.

23 Q In over 400 cases, 350?

24 A Not all of them are from the NFC, but, yes.

25 MS. SALICK: I have no further questions.

J. LINDH - RECROSS - MR. STERN

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1 THE COURT: Any recross?

2 MR. STERN: Yes.

3 RECROSS-EXAMINATION

4 BY MR. STERN:

5 Q How many of your 350 to 400 cases involve Swedish
6 Somali people?

7 A Oh, maybe ten cases.

8 Q And in those cases, did you do all the things you
9 talked about doing here?

10 A Yes.

11 Q And did you hear "inshallah" used in those cases?

12 A I don't know. I can't remember that.

13 Q Did you hear nanana used in those cases?

14 A It's impossible to remember all of that, of course. I
15 have to go back and look on each and every analysis.

16 Q So the specific things that you learned in those cases
17 don't inform what you did in this case, because you don't
18 remember them, right?

19 A No. To some extent, what I do remember --

20 Q What do you remember?

21 A Different ways they -- one thing that is common, if we
22 are talking about that population in general are the
23 different fillers, for example, are done in different ways.

24 Q That's typicality, right?

25 A Yeah, those are features that are commonly used and

J. LINDH - RE CROSS - MR. STERN

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1 they are used in different ways. That's an example.

2 Q And those wouldn't really tell you anything about who
3 it was, since they're quite typical in that population?

4 A How they are percussed can be informative.

5 Q Is there a case where that's what you used?

6 A Yes.

7 Q Tell me about that?

8 A This case fillers and like that.

9 Q Was this informed by another case where you used that
10 type of thing?

11 A What I remember what I heard, these kinds of these
12 fillers, yes.

13 Q Okay. If you heard those kinds of fillers from other
14 Swedish Somalis, they're not atypical; is that fair to say?

15 A Okay. So you have to --

16 Q Is that fair to say? Those fillers standing alone are
17 not atypical?

18 A It's not clear from your question that they actually
19 exist. It's not atypical how they are pronounced, as I
20 explained earlier, that could be atypical.

21 Q That's all I'm asking.

22 A Is that an explanation?

23 Q I'm sorry. Go ahead.

24 A No. No. You understand what I'm --

25 Q I think so.

J. LINDH - RECROSS - MR. STERN

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1 Did Mr. Yusuf, for example, MY, pronounce it in
2 some atypical way?

3 A Yes.

4 Q What is that?

5 A It's some of the examples are specified in the report,
6 like, the "E" sound.

7 Q The things that were in the report "inshallah",
8 "nanana", "brorsan", so it's the way you say it, right?

9 A Yes. Yes.

10 Q So tell me what's the difference between how he
11 pronounces it and the way that typical Swedish Somali
12 pronounces it?

13 A I can't imitate all different speakers, can I?

14 Q I don't know.

15 A No, I can't.

16 Q Now, you said I think that cognitive bias is
17 inescapable when you were asked; is that right?

18 A Yes.

19 Q But it's not inescapable, is it?

20 A What do you mean?

21 Q Well, I mean, they can have people do the same test not
22 knowing anything about what the other person is doing?

23 That's one way to try to avoid it, right?

24 A Oh, you mean blind testing?

25 Q Yeah.

J. LINDH - RE CROSS - MR. STERN

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1 A That's one way of doing the test.

2 Q They could also have given you all the intercepts that
3 were from, let's say, the Swedish intercepts, let's limit
4 ourselves to that, since that's what you had in the first
5 examination, and the videotape, and not have told you who
6 any of them were and said, did of any the people on these
7 phone calls, is that the same as the person on the
8 videotape? They could have done it that way, right?

9 A If the deadline was put somewhere next year, yes.

10 Q But that would have avoided this kind of bias, wouldn't
11 it?

12 A To some extent, yes.

13 Q So it's possible to avoid cognitive bias, right?

14 A There are some measures that you can take, yes.

15 Q And you said one way you avoid cognitive bias is by
16 actively looking for alternatives that --

17 A Differences.

18 Q Lack of alternative hypotheses, right, or stuff in
19 support of alternative hypotheses?

20 A Yes.

21 Q But that search itself can be affected by cognitive
22 bias, right?

23 A Oh, yes.

24 Q I mean, that's specifically what cognitive means. It
25 means you might ignore things that support the alternative

J. LINDH - RECROSS - MR. STERN

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1 hypothesis, because of your -- not conscious, but
2 unconscious belief?

3 A Oh, I see what you're asking. I think it's perfectly
4 clear what you're getting at, yes.

5 Q Not just clear, it's true, isn't it?

6 A Yes. Yes. Yes.

7 Q Okay. Now, you talked a lot about doing testing with
8 first not the imposter set, and then with the imposter set,
9 right?

10 A Yes.

11 Q And you talked about testing with -- I think it's Alize
12 and with Batvox, right?

13 A Yes.

14 Q Did you ever do a test that came out to a number on the
15 scale of higher than two?

16 A Now, you're referring to the likely ratio span
17 connected to the probability scale.

18 Q Well, the ordinal scale you're directed to use.

19 A I understand what you mean, yes.

20 Q You did?

21 A No, I did not reach any other span than plus two.

22 Q So whether you used the imposter set or not, or whether
23 you used Alize or Batvox, the numbers still came out on the
24 scale as a two, right?

25 A The exact number, yes.

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1 MR. STERN: Okay. Thank you.

2 MS. SALICK: Nothing further.

3 THE COURT: You may step down.

4 THE WITNESS: Thank you. Sorry again for taking
5 so much of your time.

6 THE COURT: No, please, don't apologize. We're
7 going to take lunch.

8 MR. ARIAIL: Your Honor, if I may say one quick
9 thing, just for purposes of the record, because Mr. Lindh is
10 obviously leaving right now, I just want to make sure it's
11 clear on the record if down the road we are litigating this,
12 that Ms. Kellman was provided an opportunity to
13 cross-examine Mr. Lindh and affirmatively decided not to
14 cross-examine him during this Daubert hearing.

15 THE COURT: Well, I think that's clear from the
16 record.

17 MS. KELLMAN: I want to be clear that it's not an
18 opportunity if you don't have the proper notice and you
19 can't properly prepare.

20 THE COURT: Well, as far as I'm concerned, based
21 upon what I reviewed, you had proper notice.

22 You say you filed a motion. I haven't seen any
23 motion that you filed.

24 MS. KELLMAN: I filed it at 8:00 this morning,
25 Judge.

PROCEEDINGS

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1 THE COURT: Well, you know, I did not -- I didn't
2 see it.

3 MS. KELLMAN: I asked you earlier if you had seen
4 it.

5 THE COURT: I'm not prepared to rule on it.

6 MR. ARIAIL: And, your Honor, just to be clear,
7 it's a motion to reconsider your prior decision finding
8 of --

9 THE COURT: I'm not prepared to rule on it, I
10 haven't seen it.

11 MR. ARIAIL: Understood.

12 THE COURT: All right. We're going to take lunch.
13 3:00.

14 Is that enough time for the marshals, 3:00?

15 MARSHAL: Yes.

16 THE COURT: Okay.

17 (Proceedings recessed and recalled.)

18 (Time noted: 2:20 p.m.)

19 (Continued on the next page.)
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PROCEEDINGS

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AFTERNOON SESSION

(Honorable Sandra L. Townes takes the bench.)

THE COURT: All right. All of the defendants are present, and counsel. Well, let me ask the government, do you have anything else at this time?

MR. ARIAIL: Your Honor, we do have another witness; although in terms of scheduling, I believe Dr. Wayman is not going to be available tomorrow. Our witness is here and would be available tomorrow, and it would be make sense to have Dr. Wayman.

THE COURT: Well, you said he was a rebuttal witness anyway.

MR. STERN: That's right. We're prepared to do that, but just that Dr. Wayman has to finish today. We're going to go as quickly as we can, but he has a flight tonight to Denver.

THE COURT: Okay. We'll have Dr. Wayman come up.

JAMES LEWIS WAYMAN, called by the Defendant, having been first duly sworn, was examined and testified as follows:

COURTROOM DEPUTY: Please state your name and spell it for the record.

THE WITNESS: My name is James Lewis, L-e-w-i-s, Wayman, W-a-y-m-a-n.

J. WAYMAN - DIRECT - MR. STERN

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1 DIRECT EXAMINATION

2 BY MR. STERN:

3 Q Good afternoon Dr. Wayman.

4 A Good afternoon.

5 Q Dr. Wayman, could you tell me about your educational
6 background?

7 A Yes. I received a PhD degree in engineering in 1980
8 from the University of California Santa Barbara. My
9 dissertation was in the area of architecture acoustics, that
10 is how sound fields behave in rooms.

11 And I realized very early on that there was
12 limited employment opportunities in architectural acoustics,
13 so I moved over the last few years of my PhD project into
14 the field of mathematics and I obtained my first job out of
15 the university as a professor of mathematics for the US Navy
16 at the US Naval Post Graduate School where I taught courses
17 in probability, statistics, linear algebra, calculus, and
18 even a course on orbitology, orbital mechanics to graduate
19 students.

20 Q If you move a time bit back from the mic, I think it
21 will stop that --

22 THE COURT: And talk a little slower.

23 THE WITNESS: All right.

24 THE COURT: You said you studied -- the last thing
25 you said orbitology?

J. WAYMAN - DIRECT - MR. STERN

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1 THE WITNESS: Orbital mechanics. I taught a
2 course in orbital mechanics in addition to the statistics
3 and the probability courses I was teaching.

4 THE COURT: All right.

5 BY MR. STERN:

6 Q And have you had any publications during your career?

7 A Yes. I'm a little confused on that. Earlier we cited
8 peer reviewed abstracts and conference presentations. There
9 is a draft memo circulating from the Department of Justice
10 National Commission on Forensic Science that says we only
11 should be citing peer-reviewed journal publications, and
12 journals available online.

13 So I don't know whether I should cite for you all
14 of these things or just the 34 publications that I've had in
15 peer-reviewed journals that are online and available as per
16 the recommendation of the National Commission on Forensic
17 Science.

18 Q Well, without telling me what all they were, how many
19 of the other types of things that you just described do you
20 have?

21 A If I put everything together, it would be around 100.
22 But I would never think of telling you that I had a peer
23 reviewed abstracts published, that's not something that I
24 do.

25 Q What is peer review?

J. WAYMAN - DIRECT - MR. STERN

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1 A That's a real good question, because it's not
2 straightforward. In the case of a journal article -- and I
3 should add that I review for journals and I review for
4 conferences. A journal article must be reviewed by at least
5 three people recommended by the editor as knowledgeable in
6 the subject of paper.

7 And there are extensive formats that the editor
8 must comply with. Reviewing a document for a journal takes
9 a full day. And then the editor puts the three reviews
10 together and makes a recommendation. A general
11 recommendation is rewrite your article and send it back for
12 another review. It is probably usual that there would be
13 three reviews for a journal article before it goes to
14 publication.

15 After each review, the author must change the
16 article to respond to criticisms from the reviewers. But
17 that's for full journal publications.

18 For conference publications, it's much easier. I
19 review for conferences as well, and the reviewer is asked to
20 make a few comments to the author, and then to indicate
21 whether it would be an interesting paper to see at the
22 conference.

23 If you give an invited paper to a conference, I
24 don't believe there is any review at all. I think if they
25 invite you to give a paper, I think you give the paper. I

J. WAYMAN - DIRECT - MR. STERN

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1 don't think they go through a review process.

2 Q So the kind of peer review you are talking about with
3 three reviewers and revisions and all of that, how many
4 publications do you have like that?

5 A I believe the number is 34. I believe that's the
6 number.

7 Q Without telling me every one; generally, what subjects
8 have you written on?

9 A My primary area and what I'm going to call biometrics.
10 And I mean by that automated human recognition systems. The
11 term biometrics being very controversial and being used in a
12 lot of different ways. For me, it means automated human
13 recognition.

14 I concentrated solely on that area. And in the
15 last 15 or 20 years, most of the publications have concerned
16 tests or testing of automated human recognition systems and
17 establishing error rates and uncertainty in the error rates
18 for those systems.

19 Q Tell me about your work experience, if you would.

20 A So I was professor of mathematics for five years at the
21 US Naval Post Graduate School. And during that time all
22 faculty members were encouraged to consult one day a week
23 for industry. I began consulting with Ford Aerospace on
24 speaker requisition algorithm development.

25 Q What is an algorithm?

J. WAYMAN - DIRECT - MR. STERN

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1 A An algorithm is a set of instructions for a computer.
2 It's usually expressed by saying, let's take a look at the
3 recipe for baking a cake, you know. It tells you to take
4 one cup of flour and a half cup of sugar, and then to go
5 through a series of processes to do that.

6 Any time you want a computer to complete a task,
7 you must give it specific instructions as to precisely what
8 you want it to do. So my job was to give the computer
9 specific line-by-line instructions as to what number should
10 be added, subtracted, multiplied, divided, bit reversed, so
11 that we could figure out who was speaking from a list of
12 possible speakers.

13 Q Okay. And I interrupted when you were talking about
14 your work experience, so go ahead.

15 A Okay. So in '86 I left to work for Ford Aerospace
16 full-time, and I continued the development of speaker
17 recognition algorithms for the US Department of Defense in
18 the early 90's. And this was a very important event that
19 happened.

20 I delivered to the Defense Department a speaker
21 recognition algorithm and they said to me --

22 THE COURT: Doctor, wait.

23 THE WITNESS: I'm sorry.

24 THE COURT: You know, this slips off your tongue
25 very easily, but my court reporter has to follow this, so

J. WAYMAN - DIRECT - MR. STERN

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1 I'm going to have to take many breaks with you if you don't
2 slow down.

3 THE WITNESS: I apologize to the court reporter
4 and I apologize to the Court. I'm sorry. I really am.

5 THE COURT: I'm sorry. Continue.

6 THE WITNESS: So I'll continue.

7 BY MR. STERN:

8 Q Dr. Wayman, every time I go like this, it means slow
9 down.

10 A I'm sorry. I apologize.

11 The Defense Department said to me, now test your
12 algorithm and tell us how well it works. And I realized I
13 didn't know what to do, because I could test the algorithm
14 in such a way that the results would be very, very good or
15 very, very bad.

16 I wanted to do the right and the moral thing, but
17 what is the right thing? It was my algorithm. I knew how
18 to make it work or not work, and there were no standards or
19 processes or procedures or guidelines.

20 So I became involved in the issue of biometric
21 system testing, and to try to understand how these systems
22 ought to be tested. And in the creation of testing
23 standards, not for forensic systems, but for access
24 controlled systems and systems that might have secondary
25 forensic applications, such as large-scale, automated

J. WAYMAN - DIRECT - MR. STERN

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1 fingerprint identification systems.

2 So my publications have been in testing
3 fingerprint systems, in establishing standards for the
4 testing of any type of biometric system, and for
5 understanding the uncertainty in the measurements thereof.

6 I should add that for 15 years currently, and for
7 the last 15 years, I've been under contract to the British
8 Government as well as the US Government in this field of
9 automated human recognition technology.

10 Q Have you done work with any US Government agencies?

11 A Yes, I've done work with many US Government agencies.

12 Q Such as?

13 A Such as the FBI, for example. Such as the US
14 Department of Defense. Such as the Department of Commerce,
15 that would be NIST, National Institute of Standards and
16 Technology. I worked for the Department of Homeland
17 Security. I worked for the Department of Agriculture.

18 I can't think of them all. I've done some work
19 with the Department of State, I'm not sure they ever hired
20 me though.

21 Q Have you done any teaching to US Government law
22 enforcement agencies?

23 A Yes. So I have a week-long course that I teach. I'm
24 teaching -- well, I'm teaching one day of it in two weeks.
25 The last installment I think was in November at the FBI's

J. WAYMAN - DIRECT - MR. STERN

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1 fingerprint facility in Clarksburg, West Virginia. I taught
2 a week there. I've taught several times for -- that
3 week-long course several times for the FBI, as well as for
4 other US government agencies.

5 Q Are you a member of any committees that are part of
6 your scientific work?

7 A Yes, I'm a member of a number of committees. One
8 committee of great interest, I think, should be the speaker
9 recognition subcommittee chaired by Dr. Hirotaka Nakasone of
10 the Organization of Scientific Area Committees established
11 by the Department of Justice, and NIST, which is the
12 Department of Commerce.

13 Q And tell me what that committee is about?

14 A So I have to give a bit of a historical background.
15 There was a very influential report by the National Academy
16 of Sciences in 2009 called, "Strengthening Forensic Science
17 in the United States." The thrust of that report was that
18 forensic science was too loosey-goosey. It was too -- I
19 like the word ipso-dipsy and that it needed to be
20 strengthened and the response of the Department of Justice
21 was --

22 Q Slow down. It needed to be strengthened in what way?

23 A It was the feeling of the National Academy of Science
24 committee members is that there wasn't enough science in
25 forensic science, that there was too much, well, it's my

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1 idea that, or too much -- they called it -- they called it
2 craft and guild behavior in the report. Not enough peer
3 review. Too much reliance on past traditions. Not enough
4 testing. Too few standards. Too few formal procedures.

5 And the Department of Justice responded to that in
6 a number of ways; they established the National Commission
7 on Forensic Science, and they also established this
8 organization of scientific area committees, one or in some
9 cases more committees for each of what they considered major
10 areas of forensic science, such as DNA, there is two
11 committees; fingerprint analysis, tire mark, blood spatter,
12 facial recognition; and ultimately, speaker recognition.

13 Q Are you, yourself, a forensic scientist?

14 A I don't know how to respond to that. Perhaps if the
15 word "forensic" means pertaining to the courts of law, yes.
16 I've been involved in several scientific activities that
17 directly involve courts of law. I don't do field work. I
18 -- meaning, I don't do voice examination. I generally don't
19 do forensic examinations.

20 Q Have you kept up with the literature in the area of
21 forensic examination of your specific area in general?

22 A Yes, that's what I do. Let me respond to say there are
23 some reasons that I don't do forensic speaker recognition.
24 It's not that I'm potentially not qualified; in fact, one of
25 our problems now is that there are no specific

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1 qualifications required to call yourself a forensic speaker
2 recognition examiner. So I certainly could claim that I'm
3 qualified. But the problem is number one, I don't work for
4 an accredited laboratory. And number two, there are no
5 standards, processes or procedures in place such that I
6 think I would have to argue against the admissibility of my
7 own evidence, if I was going to be really honest.

8 I don't think I'm capable of producing evidence
9 that I myself would accept as forensically valid.

10 Q Did you have any relationship with the National Academy
11 of Science?

12 A Yes. Let me speak on that. I've been involved in two
13 committees and one panel. The first committee was called --
14 in 2000 to 2002, it was called, "Authentication Technologies
15 and Their Implications For Privacy." I was the biometrics
16 experts on that committee.

17 And then in 2006, and this committee ran I think
18 for almost six years, from 2006 to 2012, simultaneously to
19 the National Academy's Report on Forensic Science, I was on
20 a committee called Whither Biometrics, where we looked at
21 automated human recognition technologies in general. And
22 what we thought their challenge -- we called it challenges
23 and opportunities.

24 And then perhaps maybe even more interesting and
25 relevant to this particular trial, I served for two sessions

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1 on the National Academy of Science Panel on Information
2 Technology, and let me explain that.

3 Every two years Congress has mandated that a
4 review be done of the National Institute of Standards and
5 Technology. I was for two, two-year periods on that panel.
6 And it was my responsibility to review the work of the
7 information access division within NIST. That's the
8 division that does all the biometric testing, including all
9 the speaker recognition testing. I chaired that subpanel
10 the last time I was on the committee, which must have been
11 2011, I think.

12 Now, subsequent to that, I'm still answering your
13 same question.

14 Q Good.

15 A My relationship to NIST. After -- and I emphasize
16 after, there is no conflict of interest here -- after I list
17 the National Academy of Science panel, I went to work for
18 NIST as the only technical assessor for the accreditations
19 of biometric laboratories.

20 The reason I have to leave here tonight is
21 tomorrow we're reaccrediting a laboratory in Denver to do
22 testing of biometric systems. And this laboratory has
23 planned this reaccreditation for a year.

24 Q But first tell me what it means to be an accredited?

25 A To be accredited?

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1 Q Yes.

2 A So there are many laboratory accreditation bodies in
3 the world, but they all follow an ISO, I-S-O, which means
4 International Organization For Standards, standard called
5 17025. I have a copy of the standard here in front of me.
6 I think it's publicly available.

7 All accredited laboratories in the world, I think
8 that's fair to say, are credited to this standard,
9 regardless of who the accrediting body is. So NIST, N-I-S-T
10 is an accrediting body. They can accredit laboratories
11 through the National Voluntary Laboratory Assessment
12 program. They can accredit laboratories internationally.
13 In fact, we accredited a German laboratory about four years
14 ago to do biometric testing.

15 Q And tell me something, why is accreditation important?

16 A Well, I'm not going to take the time to read to you
17 from this report from the National Academy of Science
18 saying, "Strengthening Forensic Science in the United
19 States, a Path Forward," but they mention it in the report
20 as one of the recommendations. And maybe I will read from
21 the National Academies as to why accrediting a forensic
22 laboratory is important.

23 Q Tell us exactly what you're reading from and the page
24 number, if you would?

25 A I'm reading from page 215 of document number 228091.

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1 MS. SALICK: Do we have it?

2 MR. STERN: No, you don't have this.

3 THE WITNESS: This is available online.

4 MR. STERN: This is my fault.

5 THE WITNESS: I can paraphrase what it says.

6 MR. STERN: Why don't you do that. You guys are
7 right.

8 BY MR. STERN:

9 Q Go ahead. Just paraphrase what it says for me and tell
10 me the source of the information.

11 A Okay. The source of my information is the report from
12 2009 from the National Academies of Science. And it says,
13 that the accreditation of forensic laboratory should be
14 mandatory. If we're going to raise the level of forensic
15 science in the United States, we can't do it in somebody's
16 backyard, we have to have accreditation to ISO 17025
17 standards or we're never going to get anyplace.

18 Q Why? What difference does it make?

19 A It makes a big difference. So let's talk about what
20 accreditation entails. To become accredited you must show
21 that you have processes and procedures in place in writing,
22 and that you are following those processes and procedures.

23 Q What are the processes and procedures?

24 A And I don't mean by this simply formats and frameworks.
25 Specific, we'll call them algorithms, for how you will test

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1 a device, a process, test whatever it is that you test. It
2 will specify exactly how data is to be treated, what exams
3 are to be done on the data, how those exams are to be
4 evaluated, what numbers are to be applied to the evaluation
5 of those exams. You will have a method in place for
6 tracking all documents, such that we won't have any document
7 confusion. For instance, two documents with the same
8 document number, but in different versions will never be
9 released by this laboratory. There will be quality
10 controlled mechanisms in place, such that all reports are
11 reviewed before release by the lab. There will be a
12 periodic review of the laboratory processes to see that they
13 are following their own written procedures. There would be
14 a person named as the quality manager; and perhaps, very
15 importantly in 17027, it says that reports from the lab must
16 come with estimates of uncertainty in the results.

17 Q And how does all of that, that you just described,
18 improve the state of the science?

19 A One of the foundations of science, I believe, is
20 repeatability and reproducibility. Repeatability means if I
21 conduct the same test on the same data, I should get the
22 same results. Reproducibility means if you conduct a test
23 using my data, you should be able to get the same results.

24 The only way we can have reproducibility and
25 repeatability, which is what we need in science, is to have

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1 some control over our processes, procedures, so that a
2 person knows exactly what you've done and can repeat those
3 processes, that algorithm, to arrive at approximately the
4 same conclusions.

5 Q All right. Now, I want to talk to you some
6 specifically about speaker recognition.

7 Is there a single way of treating speaker
8 recognition that's recognized worldwide?

9 A No. Prior to this hearing I thought there were three
10 competing methods. Now after this hearing, I believe there
11 are four competing methods.

12 The differences in the methods are very, very
13 significant, but they're a little bit hard to describe. And
14 I've watched the hearing the last two days and I thought
15 Mr. Lindh was brilliant. He was very careful about the way
16 he described his findings and his Bayesian methodology. But
17 I find myself tripping over the words, and I found some of
18 the lawyers tripping over the words, it's subtle.

19 So the point is there are four methods. One is
20 the Bayesian method, and this method is promoted in Europe
21 mainline Europe. I can discuss it at length, if you wish.
22 It's subtle. And I think what I've learned in the last
23 couple of days is it's really not attainable. It's not
24 realizable. I have lots of specific objections to the
25 Bayesian method. What I heard Mr. Lindh say, I wasn't fully

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1 Bayesian, and I sympathize and empathize with that. I don't
2 think the Bayesian method is implementable.

3 So Mr. Lindh had a modified Bayesian method, he
4 called it impressionistic. He did not give likelihood
5 ratios specifically to his results. He combined them in
6 some way with a Bayesian method from the speaker
7 recognition. So I would say this impressionistic approach
8 would be number two.

9 Q Let me stop you for a minute. Are there people or
10 countries you're specifically aware of who are proponents
11 for the Bayesian technique or the Bayesian method?

12 A Well, we both mention our friend DJ Muley. And DJ is
13 at the Netherlands Forensic Institute. He worked for a good
14 deal of time and maybe even got his PhD from the University
15 of Lausanne and Kristof Chapo (phonetic). Lausanne does the
16 work for Switzerland. The Netherlands Forensic Institute
17 does the work for Netherlands. I don't know if they have a
18 national policy, but it's the policy of both of those
19 forensic institutes to support the Bayesian approach.

20 What we heard today is it's a policy of Sweden to
21 support a modified Bayesian approach, because of the lack of
22 realism, I think, the inability to really do a Bayesian
23 analysis.

24 I hear in the United States we're going to hear or
25 what I would rather say that I have reviewed the standard

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1 operating procedures from the FBI laboratory on speaker
2 recognition. I think it is a different approach entirely.
3 They use one in which they -- their results come out as what
4 we call posterior statements. This is not only a difference
5 in reporting, it's an entirely different approach. They
6 will say the two samples matched, the two samples did not
7 match and there may be some intermediate levels of partial
8 or possible match, I don't quite remember right now.

9 And there is a fourth approach that needs to be
10 brought out. Right now I'm a proponent of the fourth
11 approach, but it may be because I'm a bit naive. I've never
12 seen the fourth approach actually used in court. And this
13 approach was mentioned by Mr. Lindh, it's the British
14 approach. 23 of 24 British researchers in speaker
15 recognition science signed a position statement saying we
16 don't like Bayesian approach, we don't like this hard match,
17 no match approach, we don't understand intermediate
18 approaches, we want something completely different.

19 And the British approach makes a lot of sense to
20 me, but maybe that's only because I haven't seen it
21 implemented. In the British approach we give a quantitative
22 number. You can maybe make it a negative four to positive
23 four of the similarity of two samples. And we give another
24 quantitative number, maybe from negative four to positive
25 four, on the typicality of those similarities.

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1 That seems, to me, a very reasonable approach
2 going forward, but I haven't seen it yet implemented.

3 So to answer your question directly, there are at
4 least four completely different approaches; not only to
5 report it, but to analysis.

6 It's not clear that those four approaches, if done
7 in parallel, would have arrived at the same results. That's
8 never been done.

9 I think I'm a proponent of the British approach,
10 but that may only be because I haven't seen it implemented
11 in a court of law, but I'm keeping an open mind.

12 Q So would it be fair to say that there is no consensus
13 in the community of people involved with this kind of
14 research as to what way it should be done?

15 A I would say that's not only fair to say that, I would
16 say it's fair to say these arguments become quite heated;
17 particularly, in the academic literature. Yes, there is no
18 consensus and, in fact, there is active disagreement in this
19 area.

20 Q Now, is there any difference between one country or
21 another, one group or another, on whether or not it's
22 appropriate to testify in court about your conclusions?

23 A Yes, absolutely, I believe so. There have been a
24 number of cases in Europe where there have been -- there is
25 testimony in court relating to speaker recognition.

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1 There was a very important case in the UK about
2 four years ago that excluded the use of likelihood ratio
3 testimony in British courts of law. I believe that British
4 courts of law do accept testimony on speaker recognition,
5 but I don't believe they will accept it now in likelihood
6 ratio terms.

7 And it's my understanding in the United States
8 that it is not generally accepted. My last court
9 appearance, as you know, was in the Zimmerman trial, and it
10 was determined in that trial that that evidence presented;
11 although not comparable to the evidence being presented
12 here, was not admissible.

13 Q And I take it that your a colleague of Dr. Nakasone's?

14 A Not only a colleague, I'm a very close, personal
15 friend. I consider him a brilliant and wonderful man.

16 Q Do you know from either professional or social
17 functions with him whether or not the FBI is allowed to
18 testify about these forensic conclusions at trials?

19 A I know the answer, but not from my social involvement.
20 I know it from reading the standard operating procedure of
21 the FBI. And I know from that standard operating procedure
22 it is in writing that the FBI does not testify to voice
23 comparisons in Courts of law in the United States.

24 Q Why is that?

25 A I think you're going to have to ask Dr. Nakasone. I

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1 can speculate.

2 Q Don't speculate.

3 A Okay.

4 Q Now, you heard some discussion with Dr. Lindh of
5 cognitive bias, do you recall that?

6 A Yes, sir, very well.

7 Q And tell me your definition of cognitive bias?

8 A Cognitive bias are these subliminal subconscious clues
9 that cause us to very subtly modify our behavior.

10 Cognitive bias is not something that you can blame
11 someone for. We all have these things. If we did not, and
12 we're not subject to cognitive bias, advertising would not
13 work. When I see in advertisement that shows a healthy,
14 strong male wearing a particular coat, I'm not stupid enough
15 to go out and buy the coat. But when I see the coat on the
16 shelf I get good feelings. I connect it with strength and
17 masculinity so I decide to buy the coat.

18 Cognitive bias is that subliminal messages that I
19 get that, you know, this is what I want to do. I really
20 want to do this. And it's been the subject of -- it's the
21 subject of extensive talk in the Strengthening Forensic
22 Science in the United States report by the National Academy
23 of Science. And it's also been a major area of academic
24 research for now the last ten years; particularly, cognitive
25 bias in the field of forensic science.

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1 Q Are you aware of ways in which cognitive bias can be
2 either avoided or lessened?

3 A I'm going to use the term "mitigated". I can never
4 avoid cognitives, but you can mitigate things so that my
5 cognitive biases are not allowed to come out.

6 For instance, in the FBI's standard operating
7 procedure for forensic speaker recognition, they have two
8 different examiners look at the evidence. The examiners do
9 not work together. They do not compare notes. And further,
10 they try to protect the examiners from too much knowledge of
11 the case. And then when both examiners have independently
12 reached their conclusions, the conclusions are compared to
13 see if there is consensus.

14 I'm not sure what happens if there is lack of
15 consensus, you'll have to direct those questions to
16 Dr. Nakasone.

17 Q Do you know if that same practice is followed in
18 Europe?

19 A I don't know.

20 Q Now, when someone is evaluating speech, is it enough
21 that there are similarities between the speech to assume
22 that it comes from the same person.

23 A One of the papers that was quoted extensively, I'm
24 sorry, one of the authors that was quoted extensively by
25 Mr. Lindh was Phil Rose. Now, I think to be fair to

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1 everybody, I don't think he referenced this specific Phil
2 Rose paper Technical and Forensic Speaker Recognition,
3 Evaluation Types and Testing of Evidence. It's a paper from
4 2006.

5 Q Go ahead.

6 A So if I'm allowed --

7 MR. STERN: One second. I'm sorry.

8 A He's talking in this paper about the likelihood ratio
9 approaches to speaker recognition. The numerator quantifies
10 the degree of similarity between the offender and suspect
11 samples, and its denominator quantifies the degree of
12 typicality of the offender and suspect samples in the
13 relevant population.

14 I'll skip down here a few sentences.

15 "Base zero makes it clear that both these factors
16 are needed to evaluate identification evidence: It is a
17 very common fallacy to ignore both base rate and typicality
18 and assume that similarity is enough: That if two speech
19 samples are similar, that indicates common origin."

20 So the err is assuming that one can simply look at
21 similarity or dissimilarity, and make an estimation as to
22 whether speech came from the same person.

23 Q Now, you heard Mr. Lindh talking about the fact that
24 some of these biometric systems are not text dependent. Do
25 you recall that?

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1 A Oh, yes. Not text dependent, correct.

2 Q And have you any information that either supports or
3 does not support that position?

4 A Let me make sure I'm clear in the question.

5 There are two types of biometric -- of speaker
6 recognition systems; those that are text independent and
7 those that are text dependent. Text dependent systems
8 require a specific password.

9 The speaker recognition system I developed for the
10 US Department of Defense was a speech dependant system. You
11 enrolled giving your password. For instance, you would say
12 "my voice is my password." That's a text dependent system.

13 A text independent system is the type of system
14 that NIST is interested in. And there, there is no
15 requirement for any specific phrase to be said, you simply
16 lower my voice as you would now, as I talk. And when I come
17 back tomorrow, I don't have to say the same words, I can say
18 any words at all, and you will recognize me.

19 Of course text independent systems are much more
20 fragile.

21 Q What does that mean when you say they're fragile?

22 A That was a term that Mr. Lindh used. It means that
23 they can easily go wrong when things start -- bad start
24 happening, like channel mismatch, for instance. And also, I
25 want to caution that many of the test results that were

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1 presented or have been discussed today were for text
2 dependent systems. And it's important to recognize that
3 equal error rates for text dependent systems are not the
4 same as equal error rates for text independent.

5 Q Which were text dependent and which were text
6 independent?

7 A You know, I haven't been through them all. I received
8 last night a second copy, and you did send it to me earlier.
9 I apologize, I should have said that. I received in the
10 past a copy of the Round Seven report from the IPG. I have
11 previously seen this, but I didn't read it. The IPG
12 generally does text dependent testing. I don't know if
13 Round Seven on Batvox was dependent or independent. Their
14 history is on text dependent, I would have to read that.
15 Any NIST test would be text independent.

16 Q Are you aware of any testing done by NIST or anyone
17 else on whether or not text independent systems are truly
18 text independent?

19 A Yeah. Yes. I guess I'm a little bit confused by the
20 question. So, yes, text independent systems are truly text
21 independent.

22 But if I could insert something at this point: I
23 heard several times here in the last couple of days that
24 NIST has tested Batvox. That's entirely correct. NIST is
25 not authorized to test commercial software systems, they do

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1 not test commercial software systems. And further, those
2 tests -- the vendor is allowed to release their own tests,
3 but they're not allowed to make any comparative claims.
4 Meaning, any claim that Batvox was number two on a NIST test
5 is first wrong. And secondly, it violates NIST policy.

6 Now what I heard this morning was a change in
7 terminology, and I heard the word Batvox core technology, or
8 something.

9 It's absolutely true that Agnitio algorithms have
10 been regularly evaluated in the NIST testing program.

11 Again, those algorithms are not allowed by the
12 protocols to be compared to any other algorithms.

13 And secondly, it's unfair to say that the Agnitio
14 algorithm is necessarily the core algorithm of Batvox for a
15 couple of reasons.

16 First all, we don't know what the commercial
17 product actually incorporates. But number two, when these
18 companies go into a NIST evaluation, they bring in a very
19 highly tuned algorithm for exactly the conditions they know
20 they're facing in the NIST test, because they are told in
21 advance what the conditions are going to be.

22 Q What do you mean by the conditions?

23 A So, for instance, we talked about channel mismatch. If
24 there was going to be a test between landline and cell
25 phone, they would know it.

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1 If there was going to be a test between landline
2 and microphone, they would know it. They could adjust all
3 of their databases accordingly.

4 They would know what language the test was going
5 to be. They would have a good estimate of the age group of
6 the speakers, knowing how the data is collected.

7 The data for this test is collected at the
8 University of Pennsylvania Linguistics Data Consortium, and
9 it involves primarily volunteering students who will pay for
10 their time to make telephone calls that are matched up via
11 computer. So we know they're dealing with young people. We
12 know they are speaking primarily in English. We know the
13 conditions of the test.

14 Q Now, I want you to talk a little bit, if you could,
15 about typicality and relevant populations. What the
16 relationship between those two things is.

17 A Well, I think we've talked about it a good deal already
18 this morning. And I think Mr. Lindh was precisely right in
19 his footnote five where he said, I think in footnote five of
20 his -- any of his reports, I think, except the first one,
21 and said, "or someone those voice was similar enough to have
22 been sent for forensic evaluation." That is an exact quote
23 of Mr. Lindh's.

24 So we have two things going on. The relevant
25 population must include not only people that sound similar

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1 enough for forensic evaluation, but the channel conditions
2 must have been similar. For instance, if we're going to
3 test -- if we're going to test a hypothesis based on a
4 telephone call, the relevant population should be telephone
5 calls. And it should consist of people like the data
6 subject. In this case, a defendant in the case. It should
7 be the same basic age group, the same linguistic type. It
8 should be the same sex, and Mr. Lindh mentioned that.

9 All of those things impact the concept of a
10 relevant population. But I want to say that there is no
11 clear understanding of what the term "relevant population"
12 would have to be. And this is a big problem, because the
13 definition of the relevant population severely impacts the
14 results of any Bayesian or partial Bayesian-based test.

15 Q Why would that happen?

16 A Let me see if I can give an example. Suppose there is
17 a hypothesis that you are listening right now to President
18 Obama. There is a great deal of similarity in this speech
19 you're hearing now and that of President Obama, and I mean
20 it in the following sense, I don't mean it with any lack of
21 humility, but I want to raise something that's obviously
22 crazy, and show how the relevant population is important.

23 President Obama and I do share some speech
24 characteristics. We both speak with moderate Midwestern
25 accents. We both use the words "I" and "we" a lot, and we

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1 both make a grammatical error. He and I both use is, is.
2 For example, the current subject under discussion is, is
3 this a scientific method. The is, is thing.

4 Now, those are some similarities in our speech.
5 That's not enough to determine whether or not what you're
6 listening to is from President Obama. We must consider the
7 typicality of those things in the population.

8 There is a large and easily accessible database
9 from the British Broadcasting Corporation on BBC
10 broadcasters. If that was taken as a typical population,
11 you would know that they do not speak with Midwestern
12 accents. They do not say "I" or "we" very often. They
13 rarely make grammatical mistakes. And one would conclude
14 that there is great similarity between this voice you're
15 hearing now and that of the President, and that these voices
16 are very atypical.

17 I can establish a likelihood ratio that it's much
18 more likely, given the hypothesis that this voice is the
19 president, to have gotten this similarity, then it would be
20 likely to get such some similarity, given the hypothesis,
21 that this voice came from a random selection from the
22 relevant population.

23 So the relevant population makes all the
24 difference in the world as to what the likelihood ratio is
25 going to be.

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1 Q Now, you've been talking some about relevant
2 population. Is there a reason the relevant population
3 considered for phonetic and morphemic investigation should
4 be different than the relevant population used in
5 biometrics?

6 A I see no reason whatsoever. Now, I'm not a phonetic
7 linguistic specialist by any means. But the same question
8 must be answered. And that is: Are these similarities
9 simply typical from the population from which the defendant
10 comes from. In both cases you have to ask that same
11 question. You can't be comparing me to British Broadcast
12 Corporation professional announcers. I'm not of that
13 population, my voice would not speak to that, of that, like
14 that.

15 Q Just one second.

16 (Pause.)

17 MR. STERN: One moment, your Honor.

18 (Pause.)

19 MS. SALICK: Your Honor, to the extent that the
20 expert is going to be talking about phonetic and linguistic
21 expertise, I believe he's admitted and his CV indicates that
22 he does not have expertise in this area, so we do not think
23 it's proper for this expert, who is very qualified in other
24 areas, to provide any opinions as to phonetic or linguistic
25 analyses.

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1 MR. STERN: We're not going to ask him. We have
2 nothing else to ask him about that.

3 THE COURT: All right.

4 BY MR. STERN:

5 Q Now, you've told us, I think towards the beginning your
6 testimony, that you were on a committee from OSAC; is that
7 right?

8 A Yes, sir. This is a committee established by the
9 Department of Justice and the National Institutes of
10 Standards and Technology to look at what is needed in each
11 specific subfield of forensic science and address those
12 issues.

13 Q And what are you doing exactly, and what are they
14 hoping to go accomplish with that committee?

15 A I'm the vice chair and the chair is Dr. Hiroataka
16 Nakasone.

17 THE COURT: Wait. Wait. You are the vice chair
18 of?

19 THE WITNESS: Yes, of the sub OSAC subcommittee on
20 speaker recognition.

21 THE COURT: All right.

22 THE WITNESS: Dr. Naksone is the chair. And we
23 have a plan for the use of three different task groups to
24 establish best practice standards for data collection for
25 reporting and for forensic speaker recognition assessments.

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1 We have a committee called the Research
2 Development Testing and Evaluation Committee that will make
3 recommendations as to how government money can be invested
4 to improve the state of the technologies, including
5 linguistic and phonetic technologies.

6 And then we have a committee called Legal Aspects
7 of Speaker Recognition. That is going to look at a whole
8 number of issues, including admissibility issues, but also
9 privacy issues, and some very specific issues in forensic
10 science that come up only with speaker recognition.

11 Q And is all of this an attempt to get speaker
12 recognition to a place where it should be admissible in
13 court?

14 A Absolutely. I would say that that's my personal goal
15 with regard to OSAC would be to raise the level of
16 competency in this field such that we could all agree that
17 testimony should be admitted.

18 Q Given the state of speaker recognition now as you know
19 it, what can reliably be done with the information and
20 technology people have now?

21 A Yeah. I -- thank you for asking that question.

22 Q You're welcome.

23 A There are a number of -- I shouldn't call them simple
24 problems, but there are a number of problems that can be
25 resolved.

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1 I was asked -- although I turned it down -- if I
2 could do an analysis of the voices on the MH Malaysia Air
3 370 air traffic control tapes. The question was: Can I
4 divide up the speech into when the pilot speaks and when the
5 copilot speaks. I wasn't interested in taking that on, but
6 that would be a very doable project. To be able to
7 recognize which voices are from the pilot, which are from
8 the copilot, and then to say transcribe those so we know
9 exactly what the pilot was saying and exactly what the
10 copilot was saying. I think that would be quite doable,
11 given the current levels of technology and understanding.

12 Q How do you compare that kind of task to what's being
13 done in this case?

14 A There is words that we use called "closed set testing"
15 and "open set testing." Closed set testing is when you are
16 absolutely certain beyond a shadow of a doubt through other
17 information that there is only a small number of people that
18 could be the source of the question recorded.

19 Q So, for example, in Malaysia Air how would that be so
20 certain?

21 A Well again, it's always questionable. There could have
22 been an unknown third person to break into the cockpit. If
23 we stipulate that that is not the case or under the
24 assumption that that could not be the case, then we know
25 there are only two people in the cockpit. Any voice coming

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1 from the cockpit had to be one of those two people.

2 But there would still be the uncertainty, uh-oh,
3 there might have been -- there is always the possibility
4 that there is some third person in there. So, you're right,
5 we still have some issues.

6 Q That's a closed set?

7 A That would be a closed set, with the possibility caveat
8 that we are never really certain that it's closed.

9 Q How does that contrast with this case?

10 A I don't know the details of this case. I don't know if
11 there is already evidence that the voice must have come from
12 one or two or some small number of speakers. I don't have
13 access to that.

14 Q Well, let's say there was no such evidence?

15 A If there was no such evidence, then what you have is
16 essentially an open set. Despite the fact that -- I don't
17 know if the number was 1,700 or maybe even 14,000 people
18 that could have made this recording, we don't know the exact
19 number, we cannot test every one of those people possibly.
20 And it's a very, very much harder problem to say that it is
21 not any one of these 1,700 people who we can't test.

22 (Continued on the next page.)

23

24

25

WAYMAN - CROSS - SALICK

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1 BY MR. STERN:

2 Q And do you think biometric voice identification is up
3 to that task yet?

4 A Thank you for saying yet. Not yet. We hope to move it
5 to that level in the future.

6 Q Okay. Thank you.

7 THE COURT: Cross-examination.

8 MR. SALICK: Thank you, your Honor.

9 CROSS-EXAMINATION

10 BY MS. SALICK:

11 Q Good afternoon, Dr. Wayman.

12 A Good afternoon. I will concentrate on speaking slower.

13 Q Thank you. So to begin, I believe you said that you
14 thought Mr. Lindh was brilliant; is that correct?

15 A I very much enjoyed his testimony.

16 Q And you have no --

17 THE COURT: I'm sorry. That wasn't the question.
18 You enjoyed his -- what was your question?

19 MR. SALICK: I apologize, your Honor.

20 BY MS. SALICK:

21 Q Mr. Wayman, on direct examination did you say that
22 Mr. Lindh was brilliant?

23 A I'm sure I used those words. I'm not sure exactly what
24 I meant, but please don't ask me to define it. I liked him.
25 I enjoyed his presentation.

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1 Q And you'd agree with me that Mr. Lindh has excellent
2 qualifications in the field of phonetics and linguistics?

3 A Again, I'm not a phonetic or linguistics expert. I
4 don't personally know any of the faculty members he studied
5 under. I can't comment on his expertise in that area.

6 I'm not questioning it. I'm not questioning it.

7 Q You're not questioning his expertise -- his
8 qualifications in any way?

9 A No.

10 Q And you'd agree that having the professional experience
11 he's had in the area of phonetic and linguistics analysis,
12 the testimony you heard about the 350 to 400 cases that he's
13 done is a lot of cases, it shows that he's an experienced
14 examiner?

15 A I want to be careful on that based on the report of the
16 National Academies of Science. One of the problems in
17 forensic science is we never really know ground truth. And
18 so it's not possible to get much feedback from our cases as
19 to whether what we determine was correct or incorrect.

20 So I want to say that, yes, 350 cases is a good
21 number of cases, I appreciate that, but without any feedback
22 as to the validity of what it was that we got right and when
23 we get it wrong, it's very hard to know what to make of
24 that.

25 Q How many cases have you provided of forensic speech

WAYMAN - CROSS - SALICK

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1 identification analysis on?

2 A None. Because, again, I'm not part of an accredited
3 laboratory. And I would question the admissibility of my
4 own results.

5 Q Mr. Wayman, did you have a chance to listen to the
6 audio samples in this case?

7 A I did not. Except I heard some of them Friday in the
8 room here.

9 Q So in no way is your testimony today attacking the
10 sufficiency of those audio samples?

11 A Yes.

12 Q No basis?

13 A No basis. And let me also make clear, I am not in any
14 way attacking Mr. Lindh's conclusions. I didn't listen to
15 the tapes. I'm not attacking his conclusions. It's the
16 methodologies that are in doubt.

17 Q Understood. Did you read Mr. Lindh's report in this
18 case, the report dated April 17th, 2015?

19 A There were two April 17th reports, 2015.

20 Q The final one. Did you read both?

21 A I've read all five of Mr. Lindh's reports, but on the
22 first report only the English handwritten pencil stuff at
23 the bottom. I've read I believe every report Mr. Lindh's
24 written, yes.

25 Q Okay. Turning to the final report in this case, did

WAYMAN - CROSS - SALICK

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1 you read that report?

2 A I read the pre-final -- see, there were two reports
3 issued that day. And this is one of the things I mean about
4 version control and the importance of having an accredited
5 laboratory.

6 Q Mr. Wayman, could you answer the question with a yes or
7 no answer?

8 A I cannot answer with a yes or no answer.

9 Q Okay. I'll move on then.

10 Do you agree that it's important to calculate the
11 sufficiency of a speech sample?

12 A Yes.

13 Q And would you agree that such things as calculating
14 next speech are an important factor?

15 A Oh, yes.

16 Q Did you see the portion in Mr. Lindh's report where he
17 calculated this next speech for each sample?

18 A Yes.

19 Q Would you agree that it's important to determine
20 whether there are -- there is compression in a recording?

21 A Thank you. Yes. I have three patents in speech
22 compression. And I love speech compression, yes.

23 Q And did you note in Mr. Lindh's reports that he noted
24 that there was possible speech compression in the video
25 sample?

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1 A Yes. He talked about compressions.

2 Q And would you agree that that is an important and a
3 careful notation of the examiner?

4 A Yes.

5 Q Would you agree that it's important to edit out any
6 disruption in the audio samples that are not associated with
7 speech?

8 A That's certainly controversial.

9 Q I'll continue. That's a sufficient answer.

10 And would you agree that after an evaluation of
11 the speeches -- of the audio samples is conducted, it's
12 important for the examiner to decide whether he can move
13 forward, he or she can move forward with that examination?

14 A Yes.

15 Q Okay. In the Zimmerman trial in which you testified,
16 you cited to an article entitled, "When to Punt."

17 Do you remember that article?

18 A It was actually a conference presentation done by Riva
19 Schwartz of the U.S. Secret Service and Joe Campbell of MIT
20 Lincoln Lab, both of whom worked with Dr. Nakasone and
21 myself on the OSAC committee. The word punt, p-u-n-t, was
22 also used by Mr. Lindh. It's a special word we use to mean
23 refuse to take the case.

24 Q So do you remember testifying about this document in
25 Zimmerman?

WAYMAN - CROSS - SALICK

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1 A Very well, yes.

2 Q Okay. And would you agree that after an examiner
3 evaluates the speech samples that he or she has provided,
4 that based on the careful examination, it's important to
5 decide whether a speech sample should be evaluated or not?

6 A Yes, absolutely.

7 Q And did you hear Mr. Lindh's testimony in this case in
8 which he said that he was not able to use two of the speech
9 samples provided to him because they were of insufficient
10 quality?

11 A I was a little confused on that point and a little bit
12 disturbed, because what I saw on one of his graphs, and I
13 don't have his in front of me, he apparently punted on at
14 least one speech sample after he had seen the results of the
15 automatic speaker recognition system output. That was
16 improper.

17 Q I believe that may not be exactly what happened.

18 A If you could bring me a copy of his second April 17th
19 report, I can find that for you.

20 Q Would it change your opinion if in the report you read
21 that Mr. Lindh evaluated the speech samples of two speech
22 samples and was concerned about their speech quality, ran
23 them through the automated system because that was the
24 protocol that he follows and regardless of the result of the
25 automated system, he disregarded those results because he

WAYMAN - CROSS - SALICK

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1 originally had found them to be insufficient?

2 A I don't accept the basis of that question. I don't
3 believe that they were discarded independent of the output
4 of the speaker recognition system. If you saw anything out
5 of the speaker recognition system and then decided not to
6 accept the speech because of the quality, that would be
7 improper.

8 Q Mr. Wayman, did you hear Mr. Lindh testify that he
9 follows certain protocols when conducting his evaluations?

10 A I heard him say that, yes.

11 Q Did you also hear him testify that according to the
12 protocols he follows, he must run automated voice
13 comparisons on every unknown sample that he receives?

14 A No, I didn't hear him say that. And I saw no written
15 protocols.

16 Q Did you hear Mr. Lindh say that he ran every unknown
17 speech sample in through the Batvox technology due to the
18 instructions in the protocols that he has developed with
19 NFC? You do not remember that testimony?

20 A I thought that he failed to -- I thought he punted on
21 some of that material because of lack of sufficient quality.
22 We may have to go back and check the record. I'm not sure
23 what he said, but I thought that he did not run all of the
24 samples because of insufficient quality attributable to at
25 least two of them.

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1 Q I can provide you with a copy of the report showing
2 that he ran every sample through the audio voice comparison,
3 if that would be of help.

4 A Then your questions don't follow because you had told
5 me earlier on that he removed some samples from
6 consideration owing to low quality.

7 Q Mr. Wayman, let me back up and maybe we can stay on
8 track with the questions.

9 In your testimony in the Zimmerman trial, do you
10 remember stressing the importance of the article, "When to
11 Punt"?

12 A Yes.

13 Q And would you agree with me that it's an important
14 consideration for every examiner that when faced with an
15 insufficient data sample, that they should reject it?

16 A Yes.

17 Q And do you also recall from Mr. Lindh's testimony that
18 he rejected two audio samples because they were
19 insufficient? Yes or no?

20 A You're confusing me. I'm not tracking any of this. I
21 thought you just told me he didn't. I don't remember
22 because I've heard from you now two different things and I
23 can't keep track in my mind.

24 Something you've said is not correct. Both things
25 cannot be correct that you told me and I've forgotten.

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1 Q I'm going to move on, Mr. Wayman.

2 A Okay, okay.

3 Q Now, you also testified that you are not an expert in
4 any way in phonetic or linguistics analyses.

5 A Yes.

6 Q So no part of your testimony today takes any contention
7 with Mr. Lindh's phonetic and linguistic analysis through
8 this case?

9 A Only to say that I never saw a written protocol on how
10 that was done. As a technical assessor that accredits
11 laboratories, I would like to see a written algorithm
12 explaining precisely how one goes about doing those things.

13 Q Understanding that you would like to see that protocol,
14 you have no basis to dispute Mr. Lindh's phonetic or
15 linguistic conclusions in this case?

16 A Correct. Other than the philosophical one.

17 Q Mr. Wayman, I'm trying to get you out of here.

18 A I understand, but this is important to me. This is
19 what I do -- this is very important to me. And if I miss a
20 plane, I miss a plane. This is so important to me. Other
21 than his failure to adequately define and collect data from
22 the relative population as per his footnote 5, meaning
23 speaker sounding similar enough to the defendant that they
24 would have been sent to further evaluation, that's a
25 philosophical issue, a scientific issue, that transcends the

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1 fact that I don't anything about phonetics, I don't.

2 Q Mr. Wayman, there's been a lot of testimony about error
3 rates in this case -- in this hearing, excuse me. And you'd
4 agree that error rates are determinations that are condition
5 dependent?

6 A Yes.

7 Q And that these error rates are also dependent on the
8 threshold that the evaluator determines; is that correct?

9 A If we're speaking in non-bayesian terms, the answer is
10 yes. For the non-bayesian, that would be correct.

11 Q Okay. And you've heard many error rates cited in the
12 testimony on Friday and today, correct?

13 A Yes.

14 Q And you'd agree with me that error rates are a baseline
15 of reliability.

16 A No.

17 Q They are not a perfect measurement of a system because
18 they are condition dependent?

19 A Yes, yes.

20 Q Okay.

21 A Yes.

22 Q And you'd agree with me that a better measurement of a
23 forensic exam would be if it was performed by a qualified
24 examiner?

25 A No, I certainly would not. And that would be contrary

1 to the findings of the National Academy of Science.

2 Absolutely would not. Error rate is important.

3 Q Do you not agree that the qualifications of a forensic
4 examiner are one of the most important things in assessing a
5 forensic exam?

6 A No. I side with the National Academies on that.

7 Q Okay.

8 A You don't want me to read out of this. One of the
9 things that National Academy suggests is that there be
10 mandatory certification -- individual certification of
11 forensic science professionals should be mandatory. We
12 don't have any certification programs now for speaker
13 recognition examiners.

14 Q And I understand that and I understand that your quest,
15 which is very noble, is to raise the standard of forensic
16 science.

17 A Correct.

18 Q Now, you talked a little bit about the NIST evaluation
19 of Agnitio's core technology, and I just wanted to clear a
20 few things up on that.

21 A Thank you for phrasing it that way. Perfect, yes.

22 Q Right. Which is how we've been phrasing it.

23 Have you read the 2012 speaker recognition
24 evaluations, the result of that examination?

25 A Yes. NIST published one paper on that. They did not

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1 name names so, yes, I saw that.

2 Q Okay. And understanding that a company may not in its
3 own publications release its NIST evaluations of its
4 products, are you aware if there are still calculations of
5 those products during the NIST evaluation?

6 A There are calculations of those products?

7 Q So even though a company may not be able to claim I got
8 this score or that score, it still did score?

9 A Oh, yes. And the company is -- the scores of the
10 company are released to the company, and the company may use
11 those scores standalone in their advertising, is my
12 understanding.

13 Q Correct. They may publicize the score they receive,
14 just not in terms of how others scored.

15 A Correct.

16 Q Have you yourself ever run a test in Batvox?

17 A Test of Batvox, no, I haven't.

18 Q Test using Batvox?

19 A No.

20 Q Have you ever attended any of the Batvox training
21 courses?

22 A No, ma'am.

23 Q Did you read the Batvox manual?

24 A No. We received a copy of some Batvox materials that I
25 skimmed through, but no.

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1 Q So it's safe to say you don't know what makes up the
2 impostor set in Batvox?

3 A No. Other than to say that -- first of all, Batvox
4 uses the terms "impostor" and "reference population"
5 different than we use in the standardized vocabulary, the
6 standard being IS2382, part 37. So I sometimes get confused
7 reading Batvox literature because their terminology is
8 nonstandard.

9 But secondly, that built-in set is going to cause
10 problems if it's substantially different than the data that
11 you're attempting to evaluate.

12 Q And understanding that you have a degree in
13 mathematical algorithms, and I apologize if I butcher the
14 type of degree you have, but you yourself have never
15 assessed the core technology that makes up Batvox?

16 A I certainly am quite conversant with both UBM,
17 universal background model, bayesian mixture models and
18 I-vectors. And I'm perfectly comfortable with lecturing on
19 either I-vectors or the lower-level UBMGMMs. And I'd be
20 more than happy to explain to you how those work. But have
21 I assessed them? No, I'm a second-level consumer. I read
22 the academic reports.

23 Q You personally have never assessed Batvox, and you also
24 personally have never used Batvox?

25 A Correct.

WAYMAN - CROSS - SALICK

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1 Q Okay. Mr. Wayman, have you ever read an FBI speaker
2 comparison report, one of the forensic examinations that the
3 FBI does?

4 A I think those are classified. And the answer is I
5 probably haven't for that reason.

6 Q And did you read the report of a gentleman named
7 Dr. Grigoras who testified to using Batvox in the Colorado
8 case?

9 A Yes, I did read that. And that was not an FBI report.
10 It wasn't classified.

11 Q We've talked a lot about cognitive bias, and I just
12 want to quickly discuss that.

13 Have you ever reviewed a forensic exam that you
14 believe does not contain cognitive bias?

15 A That does not contain cognitive bias? Probably not.

16 Q Would this include forensic examinations of DNA?

17 A I have never read a forensics examination on DNA, but
18 there are many papers published recently that suggest it
19 contains cognitive bias. One paper in particular is called
20 "Painting the Barn," by William Thompson, University of
21 California Irvine, published I think in 2012. "Painting the
22 Barn."

23 Q And have you ever read a fingerprint forensic
24 examination?

25 A Yeah. Examination?

WAYMAN - CROSS - SALICK

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1 Q A report, excuse me. A report of a fingerprint --

2 A Yes, sure. Certainly, yes.

3 Q And are you aware of any fingerprint -- excuse me. A
4 fingerprint report that does not contain cognitive bias?

5 A No.

6 Q Okay.

7 A Actually, I get a little confused because of the lack
8 of specificity in the term of "fingerprint report." I've
9 written lots and lots of reports myself on fingerprint
10 competitions.

11 Q I'm talking about forensic examinations of
12 fingerprints.

13 A Fine. That's right.

14 Q And is your answer, no, that you have not read one that
15 would not contain cognitive bias?

16 A Correct, correct.

17 Q So of all the reports you've read of DNA forensic
18 examinations and fingerprint examinations, those have
19 contained some cognitive bias?

20 A Yes.

21 Q And you talked quite a bit about accreditation and
22 accreditation of laboratories. And I understand that it's
23 your position that laboratories should be accredited, but I
24 wanted to ask you, how many international labs has your
25 organization accredited in the area of speaker recognition?

WAYMAN - CROSS - SALICK

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1 A Well, there are no standards so we accredit to
2 standards so the answer is zero.

3 Q And do you know of how many -- do you know if all DNA
4 labs in the United States are accredited?

5 A I believe there is -- I believe Congress passed a
6 special legislative requirement almost 20 years requiring
7 that. But this is outside of my area of expertise.

8 Q So to your knowledge, you don't know if DNA labs are
9 all accredited?

10 A I don't know one way or the other. I suspect they are,
11 but I don't know.

12 Q Do you know if DNA labs in the United States all follow
13 the same procedures?

14 A I believe there are standardized procedures. But
15 again, I don't know about DNA. I can't really answer.

16 Q I believe you mentioned that there is a difference of
17 opinion in how to express conclusions of a forensic exam; is
18 that correct?

19 A That's true.

20 Q And I think you mentioned there's either three and a
21 half or four, depending on if you consider bayesian and
22 bayesian modified, there are four methods currently. One of
23 the ones you mentioned was bayesian.

24 A These are methods of analysis, not a method of
25 reporting results. And I think there are far more ways of

WAYMAN - CROSS - SALICK

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1 reporting results because multiple -- different countries
2 might have multiple reporting scales. We heard that Sweden
3 has a nine-point reporting scale. That's just Sweden. I'm
4 not talking about the reporting methodologies. I'm talking
5 about the underlying evaluation philosophy.

6 Q Okay. And I believe you mentioned that currently you
7 believe that the UK approach would be best suited?

8 A It's attractive. But again, I haven't seen it used in
9 a court so we'll see.

10 Q Currently, I think you said how many people were
11 following that methodology? Was it 24?

12 A This group of 24 people in the UK put 23 signatures on
13 this position paper that was organized by Peter French.

14 Q Have you ever seen a forensic report in that method?

15 A No.

16 Q I believe you testified that the OSAC committee was --
17 one of its mandates is to raise the level of competence in
18 the field of forensic examination; is that correct?

19 A There's no written mandate, but that's our general
20 feeling. That's what we want to do, yes.

21 Q Okay. And was part of this a reaction to people
22 without the correct qualifications conducting these types of
23 examinations on insufficient sample size and models?

24 And was that the crux of your testimony --

25 THE COURT: Wait. Excuse me. You're shaking your

WAYMAN - CROSS - SALICK

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1 head. Are you answering, Doctor?

2 THE WITNESS: I didn't want to speak over her,
3 ma'am, so I was waiting till she stopped talking.

4 THE COURT: I guess you were doing the right
5 thing. I just see you shaking your head. I don't know
6 whether that's an answer.

7 THE WITNESS: I'm trying to take great pity on the
8 court reporter and not speak while she speaks.

9 THE COURT: Yes.

10 THE WITNESS: So the answer to all those questions
11 is emphatically yes.

12 BY MS. SALICK:

13 Q And was part of your -- was the crux of your testimony
14 in the Zimmerman case in reaction to the prosecution's
15 introduction of evidence provided by people without the
16 proper qualifications?

17 A You are absolutely correct. And that case has no
18 parallel here.

19 Q And you'd agree with me that it has no parallel in this
20 case because, first, you agree that Mr. Lindh is qualified,
21 right?

22 A I said that I couldn't comment on his qualification in
23 linguistics because I don't know that. But this certainly
24 is much higher level testimony than what we faced in the
25 earlier case.

WAYMAN - CROSS - SALICK

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1 Q When you read his reports, did you find them to be
2 sufficiently -- I'm sorry. I'm losing my words at this
3 point of the day.

4 Did you find them to be of much greater detail
5 than the ones you examined in Zimmerman?

6 A I did, but I found them insufficient. Let me be quite
7 clear here. As much as I respect Mr. Lindh, his reports
8 lacked adequate detail. For example, his report B3, today
9 he was asked to examine figure 4 in B3, and he admitted that
10 he included nothing in his report to explain that figure.
11 When I saw that figure, I had no idea what it meant. There
12 was no explanatory text in his report as he admitted here on
13 the stage.

14 I found all of his reports generally lacking in
15 specific detail. I thought his reports did not meet
16 adequate requirements for reproducibility. Can I finish the
17 answer to that?

18 Q I believe you answered my question.

19 MS. KELLMAN: He was in the middle of his answer,
20 Judge.

21 THE WITNESS: I found the text of his report
22 inadequate for me to have reproduced his results or for me
23 to go to another forensic examiner and ask that examiner to
24 attempt to reproduce the results. There was insufficient
25 detail in the test reports.

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1 BY MS. SALICK:

2 Q Mr. Wayman, approximately how many forensic examination
3 reports that you reviewed in your lifetime?

4 A Oh, eight, ten, I don't know.

5 Q And of those eight to ten reports, what percentage of
6 those were up to your standards?

7 A I suppose I could always find a better way to do
8 things. So probably none.

9 MR. SALICK: No further questions.

10 THE COURT: Any redirect?

11 MR. STERN: No questions.

12 THE COURT: Thank you very much. Let me ask you,
13 are you going to be able to finish your direct in half an
14 hour?

15 MR. ARIAIL: No, your Honor.

16 THE COURT: I simply need a break.

17 MR. ARIAIL: I understand, your Honor.

18 THE COURT: We are going to adjourn for today and
19 begin tomorrow morning at 9:30.

20 MR. ARIAIL: Your Honor, sorry. Just in terms of
21 timing, we all hadn't obviously realized this was going to
22 be over till Tuesday. And we had some very important things
23 that we scheduled related to this case for the early morning
24 hours tomorrow.

25 I was wondering if we could possibly start after

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1 lunch or at noon. I expect Dr. Nakasone's testimony on
2 direct to be an hour at most, maybe 45 minutes to an hour
3 probably. I don't know how long the cross would be.

4 MR. STERN: I don't think longer than that. I
5 think it may be equally long.

6 THE COURT: So we'll start at noon. Have your
7 lunch before then so we don't have to stop. Okay.

8 MR. ARIAIL: Thank you, your Honor.

9 THE COURT: Thank you. We're adjourned.

10 (Time noted: 4:36 p.m.)

11 (Proceedings adjourned until Tuesday, April 28,
12 2015, at 12:00 p.m.)

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